ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LVIII, No. 7. CHICAGO, SATURDAY, FEBRUARY 18, 1911. ISSUED WEEKLY.

BY THE

ELECTRICAL REVIEW PUBLISHING COMPANY

CHARLES W. PRICE, President and Treasurer.
A. A. GRAY, General Manager. H. S. TUTHILL, Secretary.
C. W. FORBRICH, Assistant Treasurer.

PUBLICATION OFFICE: MARQUETTE BUILDING, CHICAGO

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
Henry W. Hall, Manager.

CHARLES W. PRICE.....Editor-in-Chief
A. A. GRAY.....Managing Editor
MORTON GITHENS LLOYD.....Technical Editor
F. H. BERNHARD.....Associate Editor
HOWARD EHRLICH.....Associate Editor
C. H. SEAVER.....Associate Editor

SUBSCRIPTIONS.

One Year, United States	$3.00
One Year, Canada	4.00
One Year, Foreign Countries	6.00
Single Copy, 10 cents. Back numbers, beyond one month, each	.25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS 321
The Scope of Electrical Activities..... 324
Electrical Show at Michigan Agricultural College..... 324
Examination for Electrician..... 324
New England Section of the National Electric Light Association..... 324
New Pittsburg Section..... 324
Supplementary Chicago Telephone Report..... 324
Charles M. Hall..... 325
Properties of the Heusler Alloys..... 325
France Adopts New Value for Volt..... 326
Preventing Corrosion of Metals by Means of Electricity..... 326
Public Utilities Commission Proposed for Illinois..... 326
Public Policy Work of the N. E. L. A..... 326
Electric Power Pumping Station..... 326
The Plant of the Valencia Electricity Company.—By C. J. Webb..... 327
Advantages of Unified Electric Systems..... 329
National Isolated Plant Association..... 331
Exports to Canada High..... 331
Some Geometrical Aspects of the Three-Charge-Rate System.—II.—By Hugo E. Eisenmenger..... 332
Industrial Museum Proposed..... 336
An Electric-Vehicle Dinner..... 336
The Philadelphia Electrical Show..... 336
Elements of Power-Station Design.—XXIII.—By W. B. Gump 340
Improving an Argentine Plant..... 341
British Practice in the Conversion of Street Gas Fittings.—By Francis H. Davies..... 342
New York Section, Illuminating Engineering Society..... 344
Portable Electric Lamps for Mines..... 344
Illuminating Engineering Convention in Chicago..... 344
Publication of Lectures on Illuminating Engineering..... 344
Hydroelectric Enterprise in Brazil..... 344
Detection of Tungsten..... 344
National Independent Telephone Association..... 345
Winter Uses for Electric Fans.—By Albert Scheible..... 349
Electric Locomotives for Panama Canal..... 351
Electrically Driven Shearing Machine..... 351
Electric Forges 351
FINANCIAL REPORTS OF ELECTRICAL COMPANIES..... 352
Cleveland Railway Company..... 352
QUESTIONS AND ANSWERS..... 353
NEW ELECTRICAL AND MECHANICAL APPARATUS AND APPLIANCES..... 354
CURRENT ELECTRICAL NEWS..... 359
PUBLIC SERVICE COMMISSION NEWS..... 360
RECORDS OF ELECTRICAL PATENTS..... 366

Copyright 1911 by the Electrical Review Publishing Company.

THE GROWTH OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Among the organizations representing various phases of electrical work probably no other has shown such remarkable growth and development in resources and influence as the National Electric Light Association. With a wise appreciation of the spirit of the day, several years ago provision was made so that through individual attachment the benefit of membership in this organization is available not only to corporations which supply electricity as a commodity, but also to the operating men of these corporations. Other accessions, from workers in other branches, such as instructors in electrical engineering, manufacturers of electrical and kindred apparatus and the representatives of technical journals, have contributed to a most comprehensive constituency. Thus, through intelligent co-operation, this association has accomplished much for the dissemination of information, and the consequent advancement of the art and industry.

Within the past two or three years, so potent have been the advantages of membership that a number of the important and strong state electrical associations have allied themselves with the national organization. The latter thus becomes enriched through the infusion of new life and the sympathy of sturdy local contact, while the affiliants draw from the experiences of the greater number much that will help them solve their individual problems.

A matter for congratulation is the decision of the Canadian Electrical Association to join forces with the National Electric Light Association. The parallel running of this influential body of Canadian brothers with our own organization will afford a happy opportunity for the interchange of ideas. It is a proper indication of international comity, and a practical exemplification of the *entente cordiale* which should exist between similar organizations similarly situated.

At last report there were 6,560 members of the National Electric Light Association. This is without including any estimate of the increase which may come about through the Canadian affiliation. This number will be augmented during the next four months, and at the next convention, at New York, May 29 to June 3, it may be expected that an aggregate of considerable proportions will be announced.

FLAMING ARCS.

The use of the flaming arc lamp in street illumination is making steady progress, although, like all new innovations, it is retarded by the necessity of educating buyers and users, sometimes designated as inertia; and also by the fact that where investments have already been made in other types of lamps, the additional expenditure for first cost is naturally balked at, even in those cases where the lamp is admittedly best suited to the purpose in view. That there are many installations where this type of lamp is best adapted to meet the requirements, is hardly open to question. The high operating efficiency, the pleasing color of the light, the large area of the source as compared with lamps using clear-glass globes, and the excellent distribution which can be obtained when it is properly placed, are features which are not realized in any other type of lamp.

One difficulty which has been met with this lamp is the tendency of many users to mount it in a position much too low to give good results. This is particularly true in those installations which have been made for advertising purposes, where often there is no effort to illuminate more than a very limited area. The high candlepower of this source renders its illumination too intense for objects close to it, and when in addition the lamp is so placed that it comes within the field of vision for almost every position of the observer, it is highly objectionable. This use of the lamp tends to make it be regarded as a nuisance, and those having power to influence such installations should use it to the end of securing proper mounting and thereby improving the popular reputation of the lamp. Flaming arc lamps should never be mounted less than twenty feet from the ground, and where general street illumination is desired, double this height will give better results, as the intensity directly under the lamp is sufficient and a more uniform distribution results.

For lighting large areas the flaming arc cannot be surpassed, unless perhaps in cases where searchlights are employed. In many instances of this kind the lamps cannot be closely spaced, and it is imperative to have intense units.

A case was recently noticed where flaming arcs were proving their suitability. A large advertisement, fully 60 by 40 feet, was lighted by four lamps, and every part was distinctly illuminated. The illumination could have been increased, however, and glare avoided, by providing the lamps with reflectors, as is usually done, which would have prevented the light from radiating in useless directions.

In foundries, steel mills, erecting shops and other factories having large and high bays, flaming arcs have solved a difficult problem of illumination. In such shops traveling cranes are generally employed. It is evident that low-hanging lamps would not only have to be numerous for proper light distribution, but would constitute a decided hindrance to the free use of the crane. The use of flaming arcs, however, permits the lamps to be hung above the crane and at the same time provides an illumination of high efficiency and excellent distribution with a minimum number of lamps. Even when a crane is directly below one of these lamps, the light from the adjoining lamps provides adequate illumination for the space beneath the crane. Besides this the penetrating character of the flaming-arc rays makes these lamps particularly suitable for those shops where clouds of smoke, steam or other vapors are apt to obscure the light.

THE X-RAY IN DENTISTRY.

In the delicate professional work of the modern dentist electricity has come to occupy an invaluable auxiliary position. The superiority of the small motor drive for dental drill service in comparison with the irregular and fatiguing manipulation of this apparatus by foot power is too well known to require emphasis, and the numerous applications of electric heating, external and explorative lighting within the mouth, the use of the electric furnace, sterilizing and other apparatus of light and flexible character are thoroughly familiar to the best modern practice. The amount of energy consumption per dental office is ordinarily small, but it is spread through the off-peak hours of the day, and is therefore a desirable class of central-station business. The number of practicing dentists in even a small city is sufficient to render their integrated demand upon the central station highly desirable, especially as all current used is ordinarily billed at the lighting rate.

Less appreciated are the recent triumphs of the X-ray in the dental field. Radiographic examinations form a part of the diagnostic work of every well equipped hospital, but the advantages of this method of attacking diseased conditions are not yet fully realized in dentistry. On account of the accessibility and thinness of the facial bones and teeth the success attained in studying inflammatory and displacement conditions in bony structures elsewhere in the body has been multiplied in the practice of dentists who have taken up X-ray diagnosis. The chief difficulty in making radiographs of facial bones is due to the fact that if the plate or film is placed externally a super-imposition of shadows is secured. This may be avoided by inserting a small film within the mouth and holding it in place with fingers protected by a ray-proof glove. In the latest practice, to avoid the inconvenience of holding the photographic film in the mouth by the fingers, an impression is taken of the jaw with modelling compound. After hardening and trimming, it is reinserted in the mouth with the film upon it. The patient, by closing his teeth upon the wax impression, holds the film firmly in position, and no blurring results if the head is moved. On account of the curvature of the jaw only the two or three teeth perpendicular to the path of the ray can be shown undistorted, and hence it is undesirable to attempt to take the entire arch upon a single film.

Without attempting to point out in detail the usefulness of tooth radiographs from the dental point of view, it is interesting to note that by this means the entire field from the

crown of the tooth to the base of the alveolus can thus be minutely studied. Metallic fillings appear as black masses; the root fillings as somewhat less dense streaks; the enamel and dentine are next in density; while the root canal shows plainly as a light channel in the dentine. By means of the X-ray, dentition may be studied from its beginning to its completion, including the formation and gradual growth of the enamel germ. Inspection of root canals and root fillings can easily be done in this way without pain to the patient, and the location of foreign bodies, broken-off instruments, imperfect fillings and the incipiency of many troubles can be detected and preventive measures taken. Obscure causes of facial neuralgia and other discomforts can be ascertained, and treatment more readily applied.

The cost of taking radiographs is small in view of the small size of the films employed, and the extension of this method of diagnosis should be very rapid once its value is known to the general practitioner. As an additional source of central-station revenue the operation of X-ray machines, although intermittent, deserves the consideration of central-station solicitors, who realize that every new electrical device placed in commercial service is a benefit to the lighting company, regardless of the mistaken contention that current-consuming equipment of small size is unimportant in the effect upon the system as a whole.

ADVANTAGES OF UNIFIED ELECTRIC SYSTEMS.

The advantages of the large and unified system of electrical distribution over a number of separate and independent smaller systems is brought out in the paper presented by Mr. William B. Jackson before the American Institute of Electrical Engineers last week. The advantage is on the side of the unified system and large generating units on every score except distribution. Line losses, maintenance and depreciation, first cost and fixed charges on the distribution system are necessarily larger where the distributing or transmission lines are long and carry large quantities of power. Against these items stand the lower first cost and fixed charges of large units, lower cost of fuel (or cheap water power) per unit of energy, lower labor costs, better diversity-factor and load-factor, less percentage of spare apparatus in case of breakdown. Whether the pros outweigh the cons will depend upon the density of power requirements and other local considerations.

According to the author a saving in expenses of management and similar overhead expenses is not to be looked for in the large system, but it is generally possible to secure the services of men of greater ability in both the operating and commercial departments. Other considerations also work to the general advantage of the operating company on the large system. These are the ability to maintain twenty-four-hour service, to supply customers demanding large power at irregular times or for short duration, to supply districts through which the transmission or distribution lines pass, including farms, sparsely settled districts, small towns, etc.

Both the author of the paper and those who discussed it considered the matter mainly from the side of the operating company. The standpoint of the consumer and the general public was hardly touched upon. There are, however, advantages in the unified system from this point of view also. A system which reduces the cost of production of power will usually be able to deliver it to the customer at a lower price, eventually if not immediately. More extended service and twenty-four-hour service will enable many to use power to whom it would otherwise be unattainable or attainable only at too great expense. This assists the upbuilding of local industries. The likelihood of interruption to service is much less where several generating plants are connected in one system. The smoke nuisance is greatly mitigated by the centralization of generation, or in the case of water power entirely eliminated. The conservation of the available coal is helped by the more efficient production of power in large central stations, and by the transmission of developed water power the use of coal is obviated altogether.

Every advantage which such an extensive system of power supply has over the small plant applies equally well in a comparison between the central station and the isolated plant, provided the central-station system is of a size to which the above considerations will apply. This is in reference, of course, to the cost of power and the continuity of service. When the question of heating and other outside considerations are involved, the matter, of course, cannot rest on the cost of power alone.

THE SCARCITY OF PLATINUM.

The use of platinum has steadily increased since it began to be utilized in the electrical industry, and the price has been gradually soaring for many years. The increased demand caused an increased supply at first but latterly the supply has been diminishing. The chief supply of platinum comes from the Ural Mountains in Russia, but the best yields have been exhausted and the expense of extraction increases while the yield decreases. We can consequently anticipate a continuation of the rise in price, especially as the output is controlled by the Russian government, and unless other sources of this precious metal are discovered, the situation will eventually become acute.

Only very small quantities of this useful metal have been found in America, and while attempts have been made to develop a supply, especially from some of the sands in the Pacific States, little can be hoped for in this direction. The present indications are that Russia will continue to supply over ninety-five per cent of the total consumption. Unfortunately all of the metals which might be used as substitutes for platinum are equally or even more scarce and cannot be looked to for help.

THE SCOPE OF ELECTRICAL ACTIVITIES.

ADDRESS BEFORE CHICAGO ELECTRIC CLUB.

The wide scope of electrical activities was interestingly reviewed by Albert Scheible, research engineer, Chicago, in an instructive address delivered before the Chicago Electric Club on Wednesday, February 8. As a preface to his remarks Mr. Scheible explained the functions of a research engineer, which comprise, principally, the solving of problems of manufacturers and investors, the developing of ideas, etc.

The use of electricity as a labor-saving agent was the first phase of electrical activities considered. Mr. Scheible referred to the lifting magnet, various electrically operated machines for mines, farm machinery, etc. He dwelt particularly on farm machinery, comparing the remarkable development of this class of apparatus in Germany with the apparent lack of development in this country. The innumerable applications of electricity on the farm were briefly alluded to. The location of underground water and gas pipes by means of electricity was also classified under labor-saving applications of electricity.

The activities of electricity in banishing distance, such as in telephony and telegraphy were next referred to. Mr. Scheible spoke of wireless telephony and telegraphy and of the loud speaking telephone which has recently been introduced in somewhat different form. He also described the experiments being carried on for transmitting photographic reproductions over wire, and referred to the possibility of making vision over great distances practical.

In surgery and dentistry, electricity has been making remarkable strides. The speaker briefly outlined the possibilities of the X-ray and told how it is aiding science. The methods of locating coal, ore and water underground without boring into the surface were referred to.

Great strides are also being made by electricity in manufacturing industries. Mr. Scheible spoke of the developments in electrolysis, referring particularly to the experiments of Professor Burgess, of the University of Wisconsin, in the electrolysis of iron. The developments in the electric furnace were mentioned and a number of recent installations cited.

In electrochemical fields the bleaching of textile by means of electricity and the generation of ozone were mentioned. Mr. Scheible spoke of the many uses of ozone, including air, water and food purification, and mentioned a few of its possibilities. Electric cooking and heating was also mentioned.

E. L. Elliott, of New York, was called upon and spoke briefly regarding the field for development in electric lighting. He also added to Mr. Scheible's remarks regarding the use of X-ray in surgery.

Electrical Show at Michigan Agricultural College.

The third annual Electrical Show given by the students in electrical engineering at the Michigan State College at East Lansing, Mich., will be held the second week in March. The two previous shows have been very successful.

The features of the electrical show are principally to show the applications of electricity to domestic uses, for example, electric heating and electric cooking devices, electric washing machines and electric vacuum cleaners, also methods of electric wiring and electric lighting. A typical dining room or bed room properly lighted is frequently shown.

Examination for Electrician.

The United States Civil Service Commission announces that an examination will be held March 8 for the position of electrician in the Departmental Service with the Bureau of Standards. It is important that the applicant shall have had experience with storage batteries, and be skilled in lead burning.

Applicants should apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners as follows for application and examination form 1800 and the Manual of Examinations: Post Office, Boston, Mass.; Philadelphia, Pa.; Atlanta, Ga.; Cincinnati, O.; Chicago, Ill.; St. Paul, Minn.; Seattle, Wash.; San Francisco, Cal.; Customhouse, New York, N. Y.; New Orleans, La.; Old Customhouse, St. Louis, Mo.

New England Section of the National Electric Light Association.

The annual meeting of the New England Section will be held on March 17, 1911, at the Edison Building, Boston, Mass., at 2:30 p. m. The meeting will be devoted to routine business such as the reading of reports and the election of officers. There will be no papers read, as the executive committee has decided to omit his feature with the idea of adding to the success of the national convention.

New Pittsburg Section.

The Allegheny County Light Company and affiliated companies in the Pittsburg district have organized a Company Section of the National Electric Light Association. H. N. Muller has been made temporary chairman.

Much interest is being shown in the forthcoming meetings and the section promises to be a pronounced success.

Supplementary Chicago Telephone Report.

The Chicago City Council received on February 10 from Arthur Young & Company a report concerning the accounts of the Chicago Telephone Company which supplements the original report made last May in conjunction with D. C. and W. B. Jackson. The supplementary report is concerned with the toll revenue and miscellaneous revenue of the company.

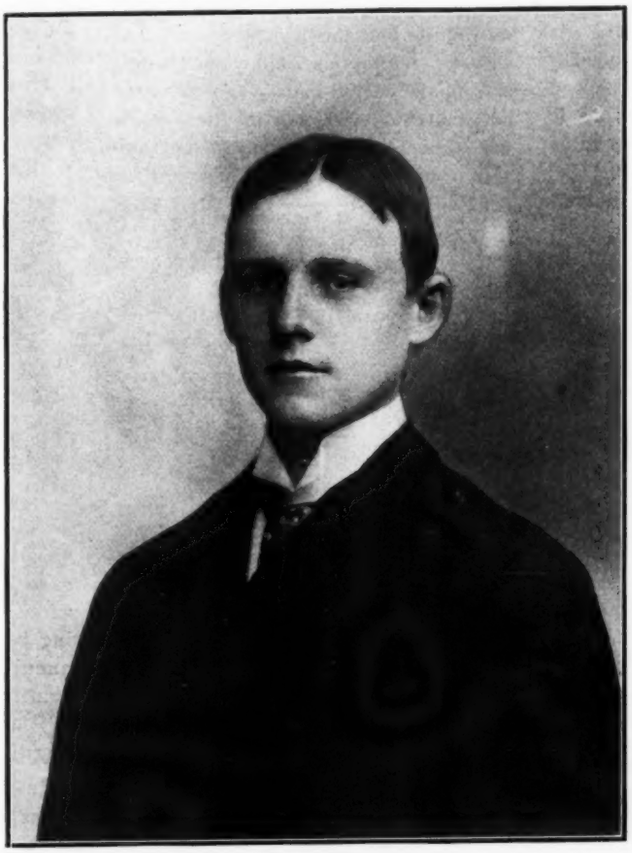
The toll charges are distributed between the exchanges and the investment within the city limits and the part of the company operating outside of the city. Fifteen per cent of the rate is allowed to the point of origin and the remainder distributed according to the mileage of the line used. The receipts are found to be $362,872 for the company's toll business and $63,246 for handling long-distance calls, making a total of $426,118. The cost of handling this business is computed to be $312,501, leaving a net revenue of $113,617.

The net receipts from rental of circuits is found to be $66,393; from real estate rentals and sundries, $56,914; the total revenue from all of these sources is thus $236,924.

The report of May, 1910, showed the other net revenues to be $890,985. The total revenue to be applied on the investment of $24,285,905 is therefore $1,127,909 or 4.6 per cent.

Charles M. Hall.

The Perkin medal, which was established in this country to honor Sir William Perkin, the discoverer of aniline dyes, is awarded to those who have made important contributions in industrial chemistry. At the January meeting of the New York Section of the American Electrochemical Society, this medal was presented to Charles M. Hall, who discovered and perfected the electrolytic process of manufacturing aluminum, which process has resulted in the production of the metal in enormous quantities and at such a low price that it has become an article of everyday use.



CHARLES M. HALL,
Inventor of Electrolytic Aluminum.

Charles Martin Hall was born in Thompson, Geauga County, O., December 6, 1863, his father being the Rev. Heman B. Hall. He attended Oberlin College, where he was graduated with the degree of A. B. in 1885, and in 1893 the degree of Master of Arts was conferred upon him. Later in life he was made a Doctor of Laws. While still at school he had been much interested in chemistry, and while in college the problem of producing metallic aluminum attracted his attention. Finally his thoughts turned to electrolysis and after many experiments a commercial process was evolved. A patent for this process was granted on April 2, 1889, the application having been made in July, 1886, and the actual invention having been made in February of that year. This patent was afterward attacked in the courts, but in a decision rendered in 1893 it was sustained and priority conceded for Dr. Hall's invention.

Some difficulties were experienced in placing the new process in the commercial field, but finally the Pittsburg Reduction Company was incorporated in 1888, and later became known as the Aluminum Company of America. Dr. Hall has been vice-president of this company since 1890. Commercial production was begun in November, 1888 at the factory near Pittsburg, where fifty pounds of metal could be produced per day. Larger works were later erected at Niagara Falls, where cheap hydroelectric power could be secured. At the present time the product is manufactured in three factories, all in the vicinity of Niagara Falls, one of them being on the Canadian side and two on the American side.

Dr. Hall is a member of the American Philosophical Society, the Franklin Institute, the American Institute of Mining Engineers and of the New York Chamber of Commerce. He is a charter member of the American Electrochemical Society, and has served as its vice-president. He is president of the Niagara Falls Memorial Hospital, and is a trustee of Oberlin College. Dr. Hall is unmarried.

Properties of the Heusler Alloys.

The most important facts regarding the magnetic alloys of copper, manganese and aluminum, are stated as follows by A. A. Knowlton, in the *Physical Review*.

Ingersoll has found that these alloys do not show the Kerr effect. This is of special importance, both on account of the theoretical importance of the phenomenon itself and because it is the only way in which the magnetic properties of these alloys are strikingly different from those of iron.

The magnetic permeability of the best specimens is about that of cast iron. Hill reports one specimen having an induction of 11,000 gausses in a field of eight gilberts per centimeter. This value is considerably above that obtained by other observers.

The permeability is often greatly increased by annealing for some time at a temperature a little above 100 degrees centigrade. At higher temperatures the alloys become non-magnetic and this transformation may be irreversible so that upon cooling to room temperature the specimen is sometimes found to have suffered a partial or, in some cases, even a total loss of magnetic quality.

The most strongly magnetic alloys were found by Heusler and Starck to be those containing manganese and aluminum in atomic proportions.

Other trivalent metals as arsenic, antimony, or tin, may be substituted for the aluminum, but the alloys thus obtained are much inferior to those containing aluminum.

Zahn and Schmidt have found a Hall effect in these alloys of the same sign as in iron, but larger than in any substance previously studied.

The precautions to be observed in the preparation of the alloy are long heating, the use of silica-free crucibles and molds, casting in hot molds, annealing to the upper limit of transformation with subsequent quenching.

The magnetic examination shows the favorable effect of annealing at the upper limit of transformation, and the unfavorable effect of annealing at the lower limit. The transformation temperature depends upon the composition.

Photographic examination shows the close dependence of the magnetic

properties upon the crystalline structure, and indicates that the crystals probably contain molecular groups which are capable of becoming magnetic under proper conditions of temperature.

The specific resistance is about fifty microhms per cubic centimeter, but varies with composition and treatment. The temperature coefficient is 0.001 to 0.002 per degree centigrade.

France Adopts New Value for Volt.

Announcement has been made by the Laboratoire Central d'Électricité, Paris, of the change in the value assigned to the standard Weston cell, in accordance with the recommendations of the International Committee. The change has been made without conflicting with the legal definition of the unit, since the Act of 1896 failed to specify the temperature at which the Clark cell should have an electromotive force of 1.434 volts. The Clark cell will hereafter have this value at some different temperature, determined by the new value assigned to the Weston cell.

The new value is now in effect in France, Germany and the United States. As soon as the change goes into effect in Great Britain we shall have a truly international set of units, since nearly all other nations secure their standards from the laboratory of one of the above four nations.

Preventing Corrosion of Metals by Means of Electricity.

A recent Australian invention to overcome troubles of corrosion and pitting in metals, especially boilers, due to electrochemical action of ingredients in water with which they are brought in contact, appears to have met with success in tests, and the owners of this invention have just made arrangements for its thorough test by the Canadian Pacific Railway in some of its engines in districts where there has been much trouble from boiler corrosion.

The plan of the invention is to introduce by dynamos weak electrical currents on to the metals intended to be protected, thus neutralizing the galvanic action of the corrosive substances contained in the water. The process can be worked from any electrical installation already in use, the amount of electricity required being extremely small and such as can be easily regulated. The process is intended to be specially used, not only for protection of boilers, but also for protecting condensers, digesters, feedwater heaters, tanks, tail shafts, stern frames of ships, etc. The invention is expected to make an immense saving by eliminating the necessity for using zinc in various forms, boiler fluids, etc., to combat corrosive tendencies, and also in dispensing with retubings and other repairs.

This new electrical process was recently tested by the professor of physics at the Melbourne (Australia) University on metals immersed, singly and in connected pairs, in sea water, both hot and cold, and in dilute acids, who reported that all hurtful galvanic action was suspended by a small expenditure of electrical power.

Public Utilities Commission Proposed for Illinois.

Prof. David Kinley, of the University of Illinois, has completed the work of drafting the administration public utilities bill which is soon to be introduced in the Illinois Legislature.

Among the salient features of the bill are: The Railroad and Warehouse Commission is given jurisdiction over public utilities; regulation and supervision are provided; a bureau of standards is established and an appropriation is made to carry out provisions of the act; every utility shall file its schedules with the commission, and all rules and regulations affecting rates; no company shall charge or collect more than is specified in the schedules.

The bill further prescribes that the commission shall prescribe for each kind of utility a suitable standard of commercial units for the measurement of quality, pressure, voltage and conditions pertaining to the service, and shall establish standards to secure the accuracy of all meters.

The trustees of the University of Illinois shall establish a bureau of standards to test all appliances used for measuring the product of any public utility. Any consumer may have his meter tested upon application to the bureau of standards.

No permit shall be granted to a second utility in the same municipality until it is ascertained by the commission that the public convenience and interest demand such second public utility.

Public Policy Work of the N. E. L. A.

For some months past the Public Policy Committee of the National Electric Light Association has been studying the various problems connected with "welfare" work, and last year the Association sent Dr. W. H. Tolman abroad to secure for it the latest data as to European practice, the chief countries investigated being Germany and England. Conditions in this country have also been looked into closely. With the object of forecasting its suggestions to the membership at the next convention in New York City, the Committee held a meeting in Washington last week, and remained in continuous session throughout Friday and Saturday, February 10 and 11, at the New Willard Hotel. There were present: C. L. Edgar, chairman; T. C. Martin, secretary; W. W. Freeman, president; N. F. Brady, E. W. Burdett, H. M. Byllesby, H. L. Doherty, G. H. Harries, S. Insull, J. B. McCall, S. Scovil, W. H. Blood, Jr., Arthur Williams, R. S. Hale, and T. E. Murray, president of the Association of Edison Illuminating Companies.

The committee discussed the subject most exhaustively, and reached conclusions to be embodied in suggestions for action by member companies, where such plans have not been put in force already, as to provision for accident insurance, sickness insurance, profit sharing by employees, and the payment of annuities as a recognition or reward for continuous and meritorious service.

Electric Power Pumping Stations.

In a paper on "Labor Saving Devices" read before the Indiana Water Works Association in annual convention at Indianapolis, February 9, F. C. Jordon, secretary of the Indianapolis Water Company, recommended the installation of electricity, wherever possible. Electrically-operated valves are of such value as time and labor-savers that it is surprising that they are not installed to a greater extent. He claimed that the use of electricity for power in the smaller pumping plants is a very economical measure. In a plant with which the writer said he was familiar, a booster station pumping three-quarters of a million gallons per day, was being operated by one man and the only matter of concern is to provide this man with employment whereby he can occupy his time profitably.

The Plant of the Valencia Electricity Company.

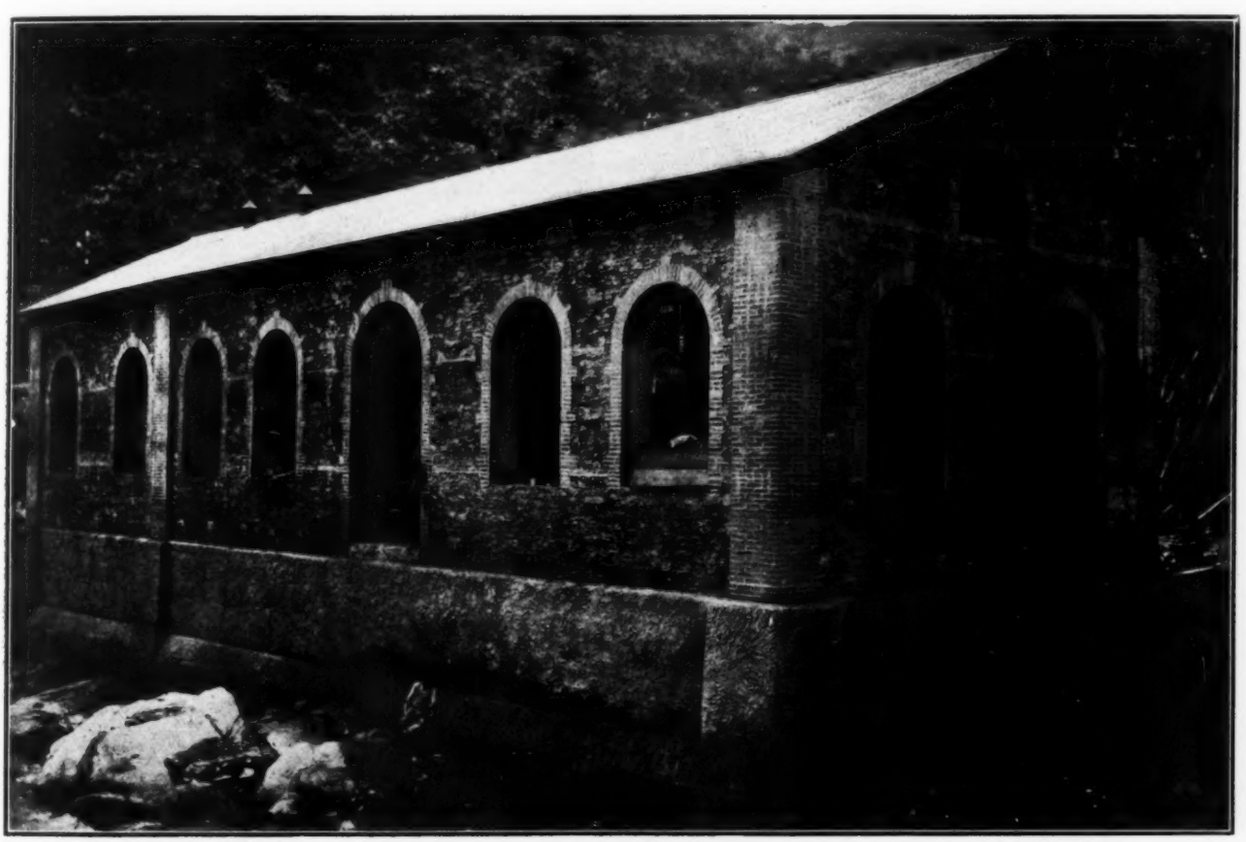
A Venezuelan Electric Light and Power Station.

BY C. J. WEBB.

About three years ago a company was formed in Valencia, a small town in Venezuela, about thirty-four miles from the coast, to erect a plant to utilize certain available water power at Aguacatal, a little place up in the mountains, about nine miles from Valencia. A small steam-operated electric lighting station was established in the town itself as far back as 1890 by the International Thomson-Houston Electric Company, which worked it until 1904, when it was taken over and carried on by Messrs. Stelling & Company, a local concern, which has since disposed of it to the new company. Messrs. Stelling & Company, in addition to supplying current for private lighting, had the concession for the public lighting, and although the old plant had given very satisfactory results, it had always been the intention to substitute for it a new one utilizing water power, owing to the increasing cost of fuel. Hence it was that the Campania Anonima Electricidad de Valencia came into existence in July, 1908.

The spot chosen for the location of the power plant was only selected after a long period of careful observation and measurement, which showed that even in the dryest season, the water supply available never fell below 40 to 44 gallons per second, while in the wet season the supply rose to over 100 gallons per second. The usual difficulties as to the purchase of the water rights were encountered, the owner putting on a high value, and as a result of protracted negotiations it became necessary to purchase the whole of the estate on which the falls are located, so that there shall be no possibility of the supply being diverted.

The engineering problem which had to be faced comprised the building of a dam across the river on which the falls exist. The dam is built of concrete, and is forty-five feet in length, thirteen feet wide at the foundation, seven feet at the top and seven feet high. The dam is furnished with a circular iron sluice gate mounted in brass; it is arranged to be operated from a distance by hand and screw gear and is intended to secure cleanliness of the intake, which is located 2,624 feet above sea level. To the left of the dam the water runs along a cemented canal, 120 feet long, 3 feet wide and 2.5 feet deep, a second sluice gate being provided in it to permit of the regulation of the water as it enters. To make doubly sure against



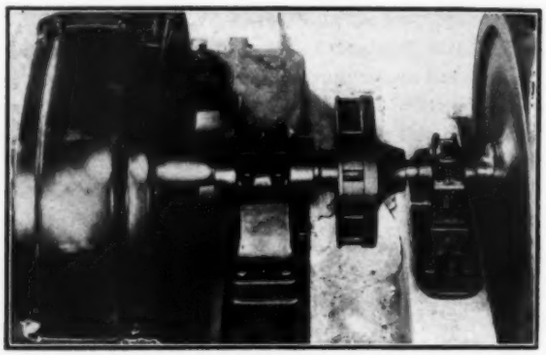
GENERATING STATION AT AGUACATAL.

the collection of any refuse or sand in the canal, an intercepting pit and a lateral sluice gate were added, by which all residue is allowed to escape at will. It is from the second water chamber that the water enters the pipe line through an iron grating.

erected to carry the pipes to their respective positions. In consequence of the undulating and broken character of the ground over which the pipe line runs a great deal of levelling work had to be undertaken, and special provision had to be made against leakage.

and a frequency of 50 cycles. They are of the three-phase, revolving field, twelve-pole type; the exciters are mounted on one end of the main shaft. The turbines were built by Messrs. Escher, Wyss & Company, of Zürich, and the whole of the electrical plant sup-

PIPE LINE SUPPORTED ON CONCRETE PILLARS.



COUPLING BETWEEN TURBINE AND GENERATOR.

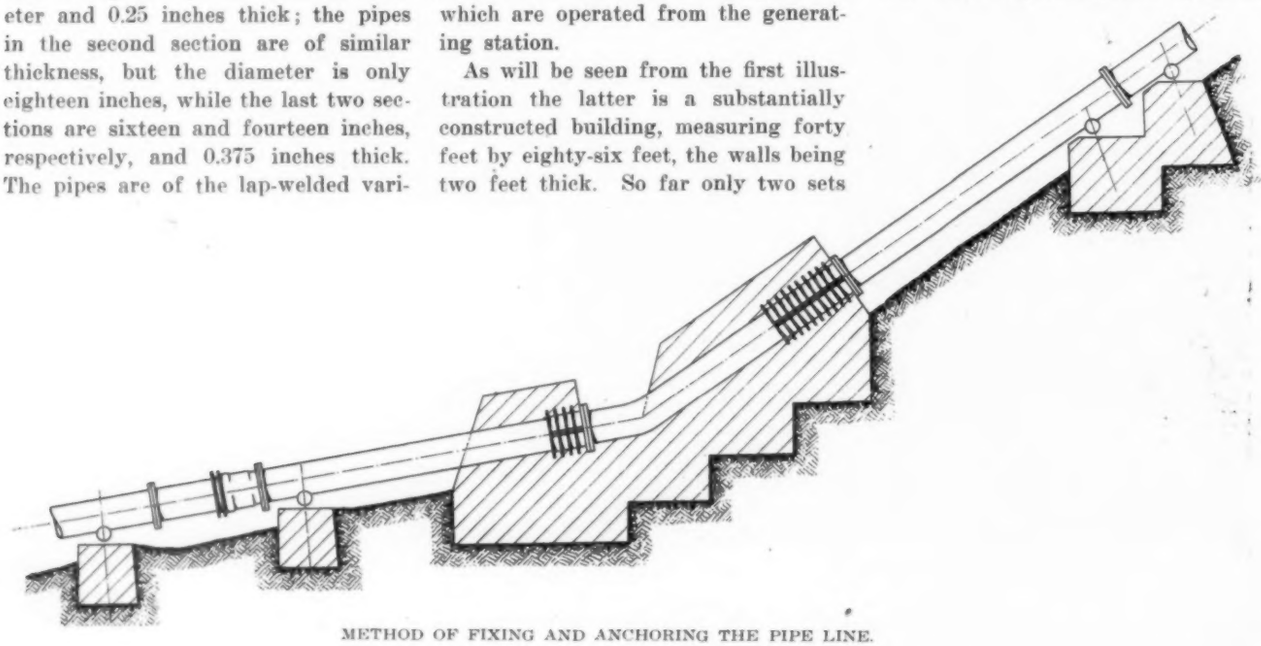
The total length of the pipe line is 5,216 feet, or nearly a mile; the intake is at an elevation of 900 feet above the generating station, the line thus having a fall of about one in 5.8. The line is built of steel pipes thirteen feet long, the first section—at the intake end—being twenty-one inches in diameter and 0.25 inches thick; the pipes in the second section are of similar thickness, but the diameter is only eighteen inches, while the last two sections are sixteen and fourteen inches, respectively, and 0.375 inches thick. The pipes are of the lap-welded variety, with joints made in accordance with the company's patents.

At every curve the pipes are anchored to large blocks of concrete, and where large openings were encountered and streams met with, pipes of greater thickness were employed and special flange connections introduced. The last pipe on the line is provided with a stop valve and two cleaning valves which are operated from the generating station.

As will be seen from the first illustration the latter is a substantially constructed building, measuring forty feet by eighty-six feet, the walls being two feet thick. So far only two sets of turbines and generators have been installed, but space is available for a third. Each turbine is of 250 horsepower and runs at a speed of 500 revolutions per minute. The two generators, one for each turbine, are connected by Zodel couplings, and have a capacity of 225 kilowatts, at 500 volts.

plied by the Siemens-Schuckert Werke, of Berlin.

A novel plan had to be adopted to convey the turbine flywheels from Valencia to the generating station; they weigh about a ton each, and as no vehicle could be obtained to carry them they were coupled together by an axle to which harness was attached, and in this way they were hauled to their destination by two bullocks.



METHOD OF FIXING AND ANCHORING THE PIPE LINE.

The carting out of the pipes from Valencia to Aguacatal was a costly operation, the whole four hundred having to be conveyed separately in the way depicted in the illustration. A steel cable ropeway had also to be

Although, as before stated, the distance of the falls from Valencia is only about nine miles, the transmission line from the generating plant to the substation in the town is approximately

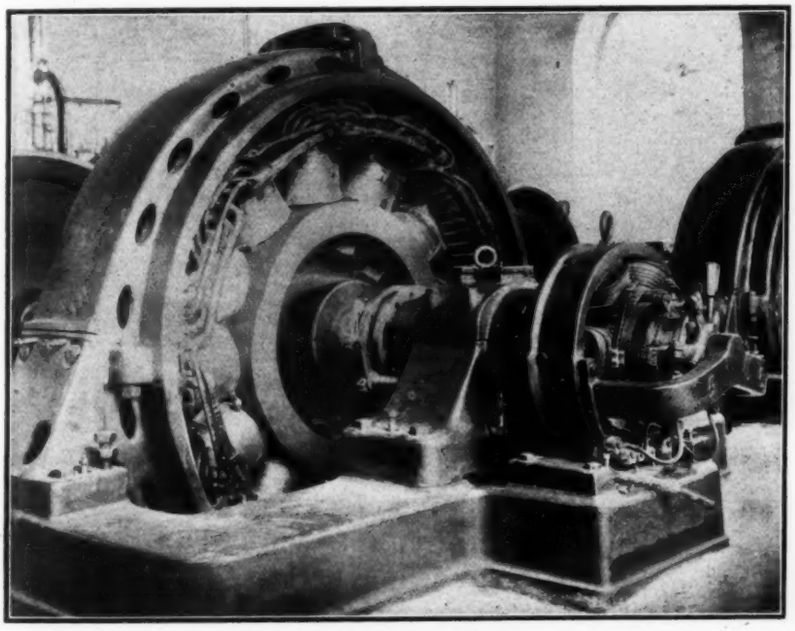
ten miles long; the wires used are B. & S. No. 4, and are carried on iron poles thirty feet high, the same poles being also utilized for the telephone wires which connect the plant with the distributing station in Valencia. The current is transmitted at a tension of 20,000 volts, and is first transformed at the reception station to 2,300 volts and later down to 110 volts; the plant at the transformer station comprises three oil-cooled transformers, one of which is kept in reserve in case of breakdown.

The plant at Aguacatal was first run to supply the arc lamps in Valencia and everything proving satisfactory the full load was switched on two days later. The arc lamps employed for the public lighting are of the inclosed type made by the General Electric Company and are served by constant-current rotary converters of the same firm's make.

At the present time the plant is supplying current, for lighting purposes, to about 100 arc and 1,000 incandescent lamps, and for power purposes, to five 50-horsepower motors in the local cotton mill, to a 60-horsepower and a 15-horsepower motor in the oil mills and to one or two small motors at a local tannery, corn mill, etc. Negotiations are at present in hand with regard to an extension of the power supply, for which a flat rate of forty cents per horsepower per day of ten hours is made. In view of the increasing demand it is already contemplated to put in a third turbine and generator at the power plant.

Owing to the various unforeseen difficulties connected with the purchase of the water rights, the laying of the pipe line and the necessity of making roads over which to transport the material, the initial estimate of cost was somewhat exceeded. The old steam-operated plant has been shut down; it is, however, intact and in perfect working order ready for any emergency.

LOADING THE PIPES.



GENERATOR AND EXCITER.

Experiments which have been carried out in Denmark in connection with the direct electrolytic extraction of copper from its ore have resulted in a new process which, it is claimed, will result in a revolution of the copper-refining industry. A 14,000-ampere low-voltage generator is used and the output is 300 tons per annum.

ADVANTAGES OF UNIFIED ELECTRIC SYSTEMS.

DISCUSSION BY AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the 255th meeting of the American Institute of Electrical Engineers, held in New York City, on February 10, a paper on "Advantages of Unified Electric Systems Covering Large Territories" was read by William B. Jackson. The meeting was under the auspices of the Electric Lighting Committee, and President Dugald C. Jackson occupied the chair. An abstract of the paper follows:

To realize one of the material operating advantages of unified electric systems, the general direction of the operations of the company must be centralized, while the local characteristics and requirements of each community must be intimately considered. This requires an organization controlled by exceptionally broad and discriminating engineering and commercial judgment.

Several factors tend toward making it economically possible to serve any territory by a comprehensive transmission and distribution system as a substitute for disconnected central stations located in the cities and villages. (1) Saving in power house equipment made possible through taking advantage of the diversity of different communities by serving them from the same transmission system. (2) Lower generating cost per kilowatt-hour due to larger plants and improved load-factor. (3) Less investment in plants per kilowatt capacity. (4) The possibility of decreased percentage of spare apparatus by appropriate arrangement. (5) Saving in cost made possible by centralized management, general superintendence, etc. (6) The possibility of providing rural and suburban service that could not be profitably reached by a local central station. (7) The possibility of large corporations providing power service which would be too extensive for small companies to undertake. (8) The development of water powers for electric service.

The savings made available by the above may be set against the losses occasioned by the transmission transformers and lines and the cost for their maintenance, depreciation and interest on investment. But it should be borne in mind that only by covering the country by electric circuits for comprehensively serving groups of cities and villages from relatively large power houses, strategically located, is it possible to serve rural districts generally with electric light and power at reasonable cost. It is seldom economically possible to serve a rural district alone.

The practicability of serving by electric transmission systems large territories comprising all kinds of communities, urban, suburban and rural, was first demonstrated by hydroelectric developments from which the transmission of the power was necessary in order to obtain a market. Astonishing development has occurred in such systems since their introduction only a few years ago. It is eighteen years since the first commercial electric transmission plant in the United States using 10,000 volts or over, was started at Pomona, Cal., while it was three years later when the first plant east of the Rocky Mountains began transmitting electric power from Lowell to Grand Rapids, Mich. The transmission from Niagara Falls to Buffalo was put into operation shortly thereafter. Today the state without hydroelectric transmission is an excep-

tion. A number of representative systems were then considered, and maps shown to indicate the territory covered. These were the Pacific Gas & Electric Company, Southern California Edison Company, Commonwealth Power Company, Grand Rapids-Muskegon Power Company, Janesville Electric Company, Niagara Falls Power Company, Hudson River Electric Power Company, Southern Power Company, and the following steam plants: North Shore Electric Company, Eastern Michigan Edison Company, and the Edison Electric Illuminating Company (Boston). The advantage in diversity-factor was shown by actual examples. Improved load-factor accompanies increased diversity-factor. The reduction of labor costs and the economy in consumption of fuel and supplies per unit of output for large plants, is well recognized. The installation costs per kilowatt are dependent upon so many variables, such as accessibility of location, character of foundations required, cost of land, quality of plant, labor saving devices installed, and efficiency, that it is not practicable to show specific relations between costs for larger plants as compared with smaller, but in general the first cost of plant shows an advantage in favor of larger stations. Some of the larger turbine stations have been built for less than $90 per kilowatt of rated output including all buildings, equipment and lands; and a detailed estimate for a very large plant has recently indicated that the total investment may go below $70 per kilowatt of rated capacity. These figures are to be compared with the usual costs of the older types of stations which have been from $110 to $170 per kilowatt of rated capacity. The percentage of space capacity required decreases. The ratio of management expenses to operating expenses is not generally decreased, but men of the highest ability in both technical and commercial lines can usually be secured, and a more efficient organization obtained. The electric lighting and power business in territories served by small central stations is seldom fully developed. This condition frequently enables a transmission company to enter a district with the certainty that a paying additional development can be made even though the existing service alone might not justify the extension. There are many instances where large power users are far from being practicable customers of small central stations, but which may be quite satisfactory customers of a comprehensive system, such as stone quarries and pumping plants for irrigation purposes. Rural service will prove to be largely an off-peak load since the power demand of an ordinary farm usually ceases at dusk. A large company is usually in better position to obtain funds for large extensions than a small one. There are many elements which tend to make service by a unified system over large territory an economic advantage, but the success of such systems depends upon making these advantages offset the losses involved in transmission circuits and their upkeep and fixed charges.

P. Junkersfeld, in opening the discussion, stated that the ultimate success or failure of any such unified electric power system depends in very large measure upon four things: (1) The general character of the territory. (2) The cost of fuel and in some cases the availability of water power. (3) The conception, financing and design of such power system. (4) The management and development of the business.

In analyzing the character of the territory, we should consider such points as size and nearness to each other of towns and villages; growing or apparently stationary population and character of population; nearness to or isolation from some larger city or metropolitan or industrial district and growth of such city or district; existing and prospective transportation facilities; tendency toward summer houses, summer resorts, amusement parks and interurban travel in any part of the territory; if the territory is agricultural, is there a tendency toward enlargement, or subdivision of farms, toward raising or fattening live stock, dairy farming or truck gardening. All of the above and others that might be mentioned under this general heading have a material influence on the amount and combined load factor of the electricity that may be used for all purposes and the economy with which it can be distributed.

The cost of fuel has a direct influence on the area that can be economically served by a unified electric system. The plants serving individual or even two or three adjacent towns or villages are of necessity in most cases non-condensing steam plants, while unified systems are or would in most cases be served by condensing steam plants, and in some cases by water power or a combination of the two. The greater the cost of fuel, the greater the margin between cost of production in condensing and non-densing plants, and hence the larger amount of investment in transmission, conversion and distribution that would be justified. This in turn means a larger amount of business for the unified system and because of the increased quantity, better load-factor and better diversity-factor, a lower cost of production. A high cost of fuel also means a greater probability that all industrial and commercial establishments will purchase the electricity they need from the unified system instead of attempting to generate electricity in isolated plants on their own premises. This again makes for lower cost of production in the unified system. After analyzing any given situation it becomes a question of experienced business and engineering judgment as to whether the time has come for a unified electric system. If great care is not taken, the losses due to unproductive investment or inefficient arrangement, will be surprisingly large.

The one thing most to be guarded against is the so-called "getting out of touch" with the various individual communities; in other words, not giving personal and prompt attention to requests and complaints and personal interest in and attention to the ambitions of the various localities. One very great advantage in unified systems is the stability of the investment. Stability of investment means lower rate of interest. This means greater borrowing power and ability to get sufficient money for construction as substantial as the ultimate economy may indicate to be necessary and also for extensions.

W. L. Robb noted that most of the unified electric systems referred to are those connected with hydroelectric developments. This is the case because there are relatively few strategic locations for hydroelectric development, and the generating stations must be centered there. Another limitation is that when we make such a development many of the parts of the system must be developed at the outset in order to make an economical installation, and at first a large amount of surplus power goes to waste. The extent of territory you can serve from a central steam system depends on the concentration of the population, largely. Small stations operate uneconomically, but when you compare a 10,000-kilowatt station against the cost of operation of a 20,000-kilowatt station, there is very little difference in the cost. Consequently, with concentrated population, large areas will not be served from one station.

Unified systems permit corporations to go into territories which could never be supplied by small stations; the small city gains then.

F. W. Darlington said that obsolescence is intimately connected with the question of unification of power plants because old electric apparatus is found unable to meet the growing demand. Centralized plants meet this because they are built for larger service. The problem of using off-peak power is also simplified, as it can be applied in large plants for electrochemical processes, fixing nitrogen, irrigation pumping and stimulation of vegetation.

George H. Lukes, in a written communication, said that when the sys-

tem covers a considerable area and supplies service to a multitude of small cities and villages, it becomes more and more difficult to maintain close relationship with municipal governing bodies and individual customers. It often seems advisable to invest the local manager with considerable authority so that he can take immediate action to remedy undesirable conditions. Certain parts of the work which might be performed more efficiently in the central office, are often delegated to the district offices, and this tends to offset somewhat the possible economies of centralized management.

In the case of one company supplying sixty towns and villages, examination has shown that not more than forty of these towns could operate independent central stations with success. Twenty towns would otherwise be without the advantages of electric service. The furnishing of 24-hour service from a small local station would invariably make necessary a much larger investment and a greatly increased maintenance and operating expense. This condition in itself prohibits the supplying of electricity for power purposes from the smaller local central stations. In the case of the sixty towns above referred to only one was giving 24-hour service prior to being absorbed by the district company. The time is rapidly approaching when it will be the duty of the company to furnish service not only to the cities, but to the rural communities. It naturally follows that the companies must be made independent of local municipalities, so that one part of a given territory cannot drive a hard bargain with the company at the expense of more remote and weaker communities.

Norman T. Wilcox, in a written communication, said that if the work is well engineered, so as to increase efficiencies, reduce costs and give fuller and better service, and that of maximum efficiency, the enterprise is likely to be satisfactory; but if the engineering is in the hands of inexperienced or incompetent engineers, the result may easily be disastrous. The right kind of engineering is even more essential than good management.

Philip Torchio compared the operation of the New York Edison Company and the London municipal and private undertakings, for the year 1909. The New York Edison Company had a total plant capacity of 173,100 kilowatts with a maximum load of 139,667 kilowatts, all of the maximum load being generated at two main stations operated in parallel. The City of London with thirteen municipal undertakings and fourteen private companies, had a total plant capacity of 235,049 kilowatts, and the sum of the yearly maxima of all the undertakings was 141,148 kilowatts. From this comparison we see that the New York Edison Company had in 1909 24 per cent spare capacity, while the City of London had 66 per cent spare capacity, which figure does not take account of the diversity-factor of the twenty-seven different undertakings; this would make the spare capacity still greater than 66 per cent.

L. L. Elden gave some results obtained in the diversity factor in the Boston Edison System in 1910. The system supplies 35 cities and towns by means of two generating and 28 substations. Considering the peak-day of 1910 in December and excluding transmission and conversion losses the ratio of the sum of the individual district peaks of their coincident peaks shows a diversity factor of 1.03. Considering the whole year's operation, this ratio is changed to 1.09, in favor of the combined system in each case.

The total losses in the transmission system and converting apparatus at the moment of the system peak aggregated 23 per cent of the total generated power. Assuming the cost of the system at $125 per kilowatt, the total saving due to diversity factor is $125,000, while the increased investment necessary on account of distribution losses is $1,375,000 or a net increase of $1,250,000. This difference in investment must be included in capital account upon which dividends must be earned, a result which can only be obtained by an increased load-factor on the generating station, and more economical management of the combined system. One of the most serious problems before the larger company is the disposal of the discontinued generating equipment of the smaller companies in a manner which will not impair the financial interest of the controlling company. Generating apparatus maintained after consolidation is sometimes in excess of the capacity of that previously maintained by the several companies. This may be due to the introduction of larger and more economical units, and to the reluctance of the management to abandon perfectly good and modern apparatus which may be of value in emergencies or during peak loads. As an example of improvement in load-factor on the main generating station due to the absorption of several companies into our system, an increase of 10 per cent was noted by an addition of business aggregating 7 per cent. The most important result of consolidation is the ability to serve large interests with practically unlimited amounts of power at rates and under conditions prohibitive in the smaller companies.

Charles P. Steinmetz disagreed with the statement about the limit due to the size of the system. Every increase of size by consolidation of several systems, permits further economy. There is no doubt that with a demand increasing from several hundred thousand kilowatts to possibly millions of kilowatts, we shall reach finally superior economies.

National Isolated Plant Association.

At a meeting of the National Isolated Plant Association held in New York, January 30, a constitution was adopted and the following officers elected: President, C. G. Armstrong, consulting engineer, New York; vice-president, F. E. Stiles, chief engineer West Street Building, New York; secretary, E. D. Fieux, Wing Manufacturing Company, New York.

As yet the complete program of procedure has not been decided upon, but the object of the Association is to "make complete tests upon numerous isolated plants now in operation with a view to collecting cost data for the enlightenment of the owner against the encroachment of the central-station solicitor."

Exports to Canada High.

Canada purchased from the United States in the eight months ended November 30, 1910, electric insulators and batteries and telephone and telegraph instruments valued at $2,417,569 and only $53,209 from all other countries.

SOME GEOMETRICAL ASPECTS OF THE THREE-CHARGE-RATE SYSTEM.—II.

BY HUGO E. EISENMENGER.

THE EFFECT OF DIFFERENT RATES ON DIFFERENT CLASSES OF CUSTOMERS.
(*Continued.*)

(*e*) *The Paraboloid of Kilowatt-Hour Price.*—Another very interesting and instructive way to see the influence of a variation of the rate point on the plane is a graphical investigation into the *price per kilowatt-hour* which each customer pays under different rates.

The number of kilowatt-hours consumed, although not being a measure of the expense the customer causes, still is a measure of the amount of lumen-hours, energy, etc., he gets with certain types of lamps, motors, etc., and therefore is a measure of the value from the customer's standpoint.

Let d again be the respective customer's maximum demand in kilowatts and e his energy consumption in kilowatt-hours per year, then the price b paid by this customer per kilowatt-hour (not to be confused with the kilowatt-hours charge z) will be

$$b = \frac{x + yd + ze}{e} = \frac{x + yd}{e} + z$$

$$(b - z)\, e = x + yd \qquad (4)$$

$b-z$ is the excess of price per kilowatt-hour for this customer over the kilowatt-hour charge z.

In order to see what the price per kilowatt-hour to the customer for a given system of charges is, let the *three charges*, x, y, z, *be constant* and let b, e, d be the co-ordinates of a solid system. In Figs. 7 and 8, b is chosen as the vertical co-ordinate, d as the horizontal and parallel to the tracing surface, and e as normal to the tracing surface. Equation (5) represents then a *hyperbolic paraboloid*.

It should be remembered that there is one separate paraboloid for each set of charges x, y, z, and that for this paraboloid x, y and z are constants; the variables are d, e and b.[10]

If we pass a plane through the vertical axis of co-ordinates (axis of b) so that it includes a certain angle with the plane of bd, then all points on this vertical plane will have a constant ratio $e/d = tan\ \lambda$; e is expressed in kilowatt-hours per year, d in kilowatts; therefore the quotient e/d will be the load-factor expressed in hours (use of maximum demand) per year. The intersection of the paraboloid with this plane gives the cost per kilowatt-hour to customers of all sizes with this particular load-factor. It is evident that only the part of the surfaces between 0-per-cent and 100-per-cent load-factor is of any practical use and therefore only this part of the surfaces has been drawn in heavy lines in Figs. 7 and 8, whereas the part between the 100-per-cent-load-factor plane

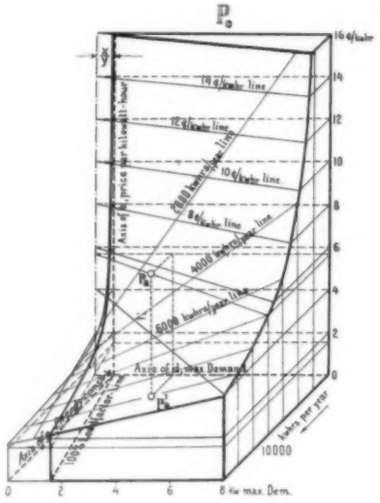


FIG. 7.

and the bc plane has only been shown in thin lines.

Fig. 7 gives the paraboloid for the real ratepoint P_o and Figs. 8a-8f show these surfaces for the points P_1 to P_6 (see Fig. 6), where P_1, P_2.....P_6 are points on the plane of rates which have either the same x, or the same y, or z as P_o. The paraboloid for P_o has been drawn over each one of the Figs. 8 in thin dashed lines, so as to make comparison with the prices at the original rate P_o easier. The line of intersection between the two surfaces has been shown in each instance and moreover that part of the surface which is lower than the surface for P_o is shaded, thus indicating the part of the surface corresponding to the favored customers. The projection of the line of intersection between the two surfaces on the plane of d e is a straight line (as can easily be seen from the figures or also can be shown algebraically) and this straight line of course is the familiar line of unchanged bills. This line then also has to pass through the characteristic point of the average customer p_a' since, as we saw, the price the average customer has to pay is not affected by a change of rates on the central-station's plane. This will hold true for the paraboloids of all points of the central-station's plane. $p_a'p_z$ then is the price per kilowatt-hour to the average customer. As this is constant all the paraboloid surfaces have to pass through p_a.

Figs. 8*a*-8*f* demonstrate very clearly how the line of unchanged bills is revolving around p_a' as the new point of rates is led all around P_o and how it assumes the positions indicating average load-factor, average energy consumption and average maximum demand for unchanged x, y and z, respectively. To give a better impression of how the surfaces are changing, Figs. 8*c* and 8*f* corresponding to points P_3 and P_6 have been drawn on top of each other in Fig. 8*g* in such a way that on either side of the curve of intersection only the lower surface has been outlined, that is, P_3 on the right side (large maximum demand) and P_6 on the left side.

The lines used for shading the surfaces are in all cases the intersections of the surface with horizontal planes.

Figs. 8*h*-8*j* represent the prices per kilowatt-hour to the different classes of customers for the points P_x, P_y, P_z of Fig. 6 (customer unit-charge rate, flat rate and straight meter rate).

Fig. 8*k* represents the Hopkinson rate or the Wright maximum demand rate.[11]

10 Some interesting qualities of this paraboloid which are of good use for obtaining a clearer comprehension of the shape of the surface can be found in the following way. (See Fig. 7.)

Set e = a constant e_o, then the remaining equation between the variables b and d represents the line of intersection between the paraboloid and a plane parallel to the b d plane.

$$(b - z)\, e_o = x + yd$$

$$b = \frac{y}{e_o} d + \left(\frac{x}{e_o} + z\right)$$

This is the equation of a straight line rising from the plane of de at an angle, the tangent of which is y/e_o; the smaller e_o is, the larger is this angle.

Again, if we set the vertical co-ordinate $b = b_o$ = a constant, we get also the equation of a straight line, this time in a horizontal plane, between the variables d and e:

$$(b_o - z)\, e = x + yd$$

$$d = \frac{(b_o - z)}{y} e - \frac{x}{y}$$

This straight line intersects the bd plane ($e = o$) at the distance of $d_o = -x/y$ from the axis of b; d_o, therefore, is independent of the value of b_o and all horizontal straight lines on the surface of the paraboloid intersect the bd plane at the same distance from the axis of b (see Fig. 7). We can draw, therefore, through every point on the surface of the paraboloid two straight lines which will be lying entirely in the surface of the paraboloid. In other words, the surface is composed of two sets of an infinite number of straight lines, one set being horizontal lines (b constant for each line), the other one parallel to the bd plane (e constant for each line) and each line of one set intersects every line of the other set.

This can be used for giving a good idea of the shape of the surface as has been done in Figs. 7 and 8, where the horizontal lines for 2, 4, 6, ...16 cents, and the lines of the other set for e = 2000, 4000, 6000, ... 14,000 kilowatt-hours per year have been drawn.

11 The difference between the Hopkinson and the Wright rates is as follows: the Hopkinson rates fix a certain basic charge y per kilowatt maximum demand and on top of this the customer is charged a certain amount z per kilo-

x=the customer expense in dollars per customer per year;
y=the demand expense in dollars per kilowatt of maximum demand of the customer per year;
z=the output expense in dollars per kilowatt-hour sold;
C=the average number of customers;
D=the sum of the customers' maximum demand;
E=the energy sold per year in kilowatt-hours;
A=the amount of the total expenses for multiple service in dollars.

It can be seen from this drawing that the price per kilowatt-hour is constant for any given load-factor with the Hopkinson and Wright systems (and the flat rate Fig. 8*i* and the straight meter rate Fig. 8*j* as well), the constant-load-factor curves on the surface being horizontal straight lines. By introducing a customer charge x these horizontal straight lines change into hyperbolas (compare for instance Figs. 8*a*, 8*c* and 8*f*), which at a fixed load-factor give higher kilowatt-hour prices than the Hopkinson system for small customers, lower ones for large customers.

For the purpose of comparison the surfaces for two kinds of modified meter rates (discounted and sliding scale) have been worked out in Figs. 8*l* and *m*. These surfaces cannot be made to follow even approximately the surface of expenses as shown in thin dash lines and the irregular broken shape of the line of unchanged bills is evidence of the arbitrariness of this system.

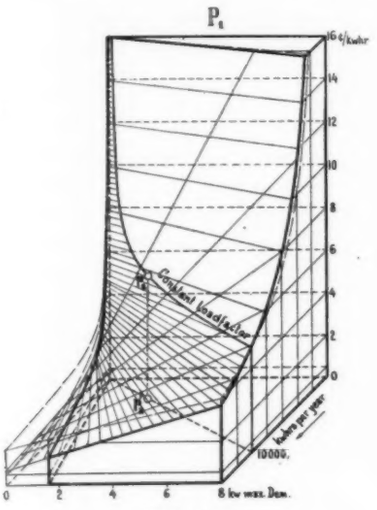


FIG. 8a.

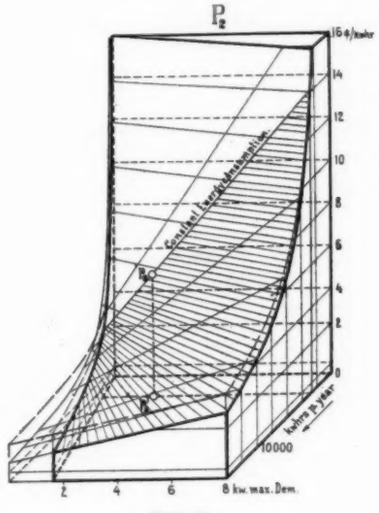


FIG. 8b.

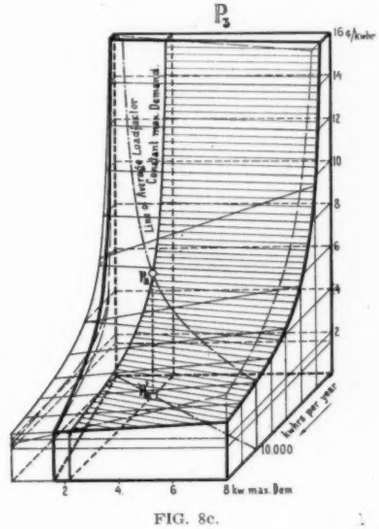


FIG. 8c.

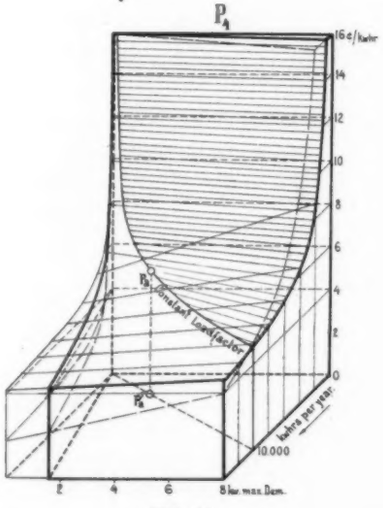


FIG. 8d.

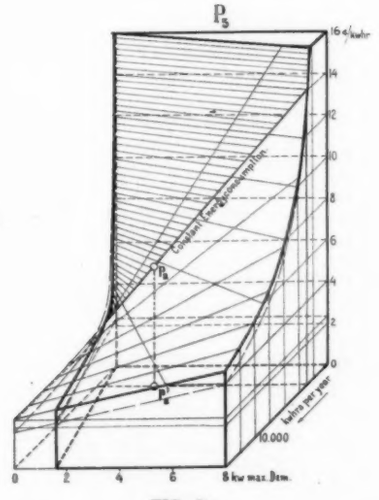


FIG. 8e.

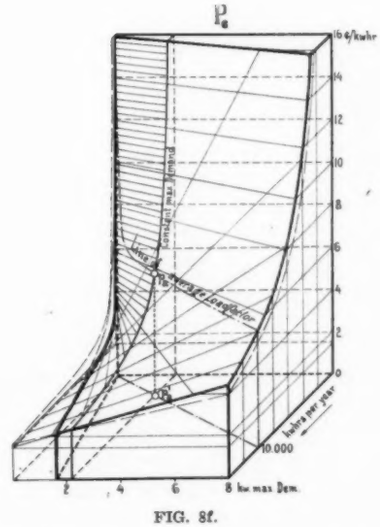


FIG. 8f.

(*f.*) *The Customer's Plane.*—The amount of an individual customer's bill under a certain combination of rates x, y, z, will be

$$x+dy+ez=a \quad (5)$$

We have above been discussing this

watt-hour consumed, whereas the Wright system takes care of the fixed charges in an indirect way by establishing two separate kilowatt-hour charges, z_1 and z_2 and specifying that the customer has to pay the higher charges z_1 until he has reached a number of kilowatt-hours corresponding to a certain number of hours t use of his individual maximum demand; after this he is charged the lower kilowatt-hour charge z_2 for the rest of the billing period.

The price per kilowatt-hour in the Hopkinson system is then

$$b = \frac{yd}{e} + z$$

corresponding to equation (4) if the customer charge is zero, and in the Wright system (if e is greater than td)

$$be = z_1 td + (e - td) z_2$$

$$b = t(z_1 - z_2)\frac{d}{e} + z_2$$

which exactly corresponds to the equation for the Hopkinson rates if $y = t(z_1 - z_2)$.

But if e is less than td, $b = z_2$, and this is the effective difference between the two systems of rates. The Wright system never can make a customer pay more than a certain moderate maximum z_2 per kilowatt-hour (represented by the shaded triangles in Fig. 8*k*), whereas the Hopkinson system follows the surface of the paraboloid theoretically into infinity without any such arbitrary breaks.

equation (which is essentially identical with equation 2) from the point of view that the rates x,y,z are constant for each separate case and that d, e and a are the variables; in other words, we have been discussing how a *definite* system of rates acts on the various classes of customers, that is, on the *general* customer. We will see now how one *individual* customer is affected by a *general* position of the point of rates; in other words, take the characteristic factors of the customers, d and e, as constants and x, y and z as variables.

We can then refer to the same system of co-ordinates (xyz) which is in use for the plane of rates. Equation (5) again represents a plane which shall be called the *Customer's Plane R* (Fig. 9) in distinction from the *Customers' Bills' Plane B*, and the *Central-Station Plane*. The angles λ_r, ϵ_r and δ_r of the customers' plane correspond to the angles λ, ϵ and δ of the central-station plane and their tangents equal the *individual* customer's load-factor, his yearly consumption in kilowatt-hours and his maximum demand in kilowatts respectively. These angles, therefore, are the same for that customer independently of what the rate system is. Whereas, therefore, the direction of the customer's plane is determined exclusively by the characteristic factors of the customer, nothing is said so far about its position in space, *i. e.*, about its distance from the origin. This distance is dependent on which set of rates xyz is chosen; in other words, on the position of the rate point.

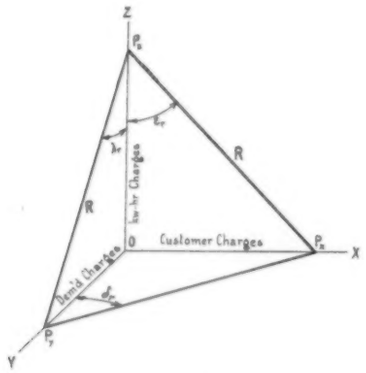


FIG. 9.

According to its equation (5) the customer's plane has to pass through the rate point P (xyz); the intercepts on the axes are found from equation (5) by setting two of the co-ordinates equal to zero:

$y = 0$, $z = 0$, $OP_x = a$ = amount of bill (see Fig. 9);

$x = 0$, $z = 0$, $OP_y = a/d$ = price per kilowatt connected;

$x = 0$, $y = 0$, $OP_z = a/e$ = price per kilowatt-hour consumed.

A customer whose characteristic factors d_a, e_a and λ_a equal the average of the characteristic factors of all customers has been called the "average customer." From this definition it follows that $d_a = D/C$ and $e_a = E/C$.

It has been shown that D/C is represented by the tangent of the angle δ (Fig. 1) and E/C by $tan\ \epsilon$. A similar reasoning shows that the tangents of the corresponding angles δ_a and ϵ_a in the average customer's plane equal d_a and e_a, and, since $d_a = D/C$ and $e_a = E/C$, δ_a must be equal to δ and ϵ_a to ϵ. Consequently the "average customer's plane" is parallel to the "central-station plane" and since both have the point P in common *both planes are identical*. This is a geometrical proof for what we have seen above that the average customer's bill is not changed by any change of rates of the rates plane[12].

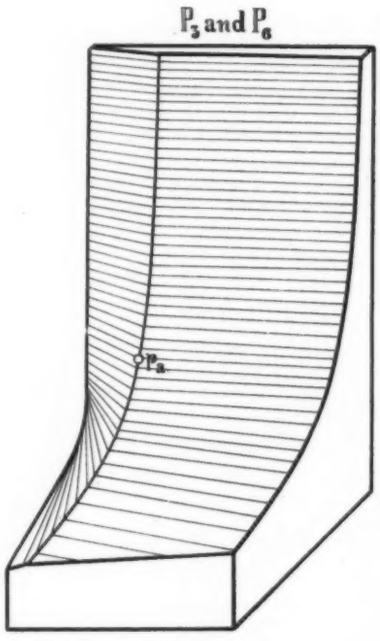


FIG. 8g.

The individual customer's plane will intersect the central-station plane in the line MP_oN (Fig. 10).

Any change of the point of rates along the line MN will obviously leave $OR_x = a$ unchanged and a change of the rate point in any other direction on the plane of rates may be resolved into two components, one in the direction of MN and the other normal to it. Only the latter will be of any influence on that customer's bill. It is seen from Fig. 10 that on one side of this line of intersection, MN, the customer's plane is "below" or "lower than" the central-station plane, on the other side "above" it (by these short terms "below," "lower than," "above," etc., is meant that a radius vector issuing from the origin will first intersect the "lower" plane "below" and then the other one "above"). It is evident that everywhere where the customer's plane comes "below" the central-station plane the customer does not pay what he ought to and will therefore belong to the favored class and *vice versa*.

THE EFFECT OF DIFFERENT RATES ON THE CENTRAL STATION.

We will now determine what will be the result *to the central station* if the rates are chosen on a point P_m in a general position on the central-station plane instead of P_o. (P_o shall designate from now on the "real point of rates"). For this purpose let us imagine that the station had been charging according to the real rate point P_o for a certain length of time and acquired a certain number of customers with a given character of demand of the average customer and then changed over to a rate-point P_m, still on the central-station plane (Fig. 10).

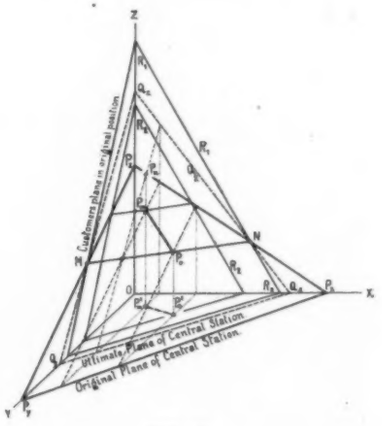


FIG. 10.

We then have the central-station plane identical with the plane of the average customer. The inclination of this plane towards the axes is determined by the character of service for the *average* cus-

[12] The customer plane also is the locus of all the combinations of customer, demand and output charges which could be applied to this particular customer to make him just pay the expense he causes.

x=the customer expense in dollars per customer per year;
y=the demand expense in dollars per kilowatt of maximum demand of the customer per year;
z=the output expense in dollars per kilowatt-hour sold;
C=the average number of customers;
D=the sum of the customers' maximum demand;
E=the energy sold per year in kilowatt-hours;
A=the amount of the total expenses for multiple service in dollars.

tomer (load-factor, maximum demand and kilowatt-hour consumption). The distance of the plane from the origin O is determined by the economy of operation and organization.

The immediate effect of the change of rates on the individual customer in general will be a change of his bill, which finds its graphical expression (Fig. 10) in shifting the customer's plane R_1 from point P_o to point P_m, remaining parallel to itself (position R_2). (It should be remembered that the intercept of the customer's plane on the X axis represents the amount of his bill.)

Thus some classes of customers will get their unit of light or power—in short, their kilowatt-hour—cheaper than under the old rates, others will see their bills increased. The result will be that the first-named class of customers will increase in numbers and importance partly by acquisition of new customers of those classes who had not seen fit to connect to the central station's lines under the old rates and partly by changing the character of consumption of some of the old customers from one class to another. Thus, for instance, if the rates, by giving lower kilowatt-hour charges favor the long-hour users and large energy consumers (see Fig. 6), a number of customers who heretofore for the sake of economy have been burning their lamps only as long as absolutely necessary may find it now compatible with the capacity of their pocket-book to leave their lights burning even in rooms which are not occupied at the time being, as the difference of cost will be smaller than under the old rates. The consequence is that this customer becomes more of a long-hour and large-energy user or, generally speaking, drifts toward the favored class. In another case a large factory which had its own generating station may see fit to connect up to the central station under the influence of some change of rates which favors large energy users by increasing the customer charge and lowering the

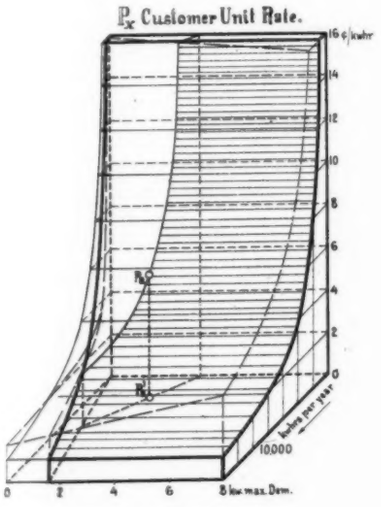


FIG. 8h.

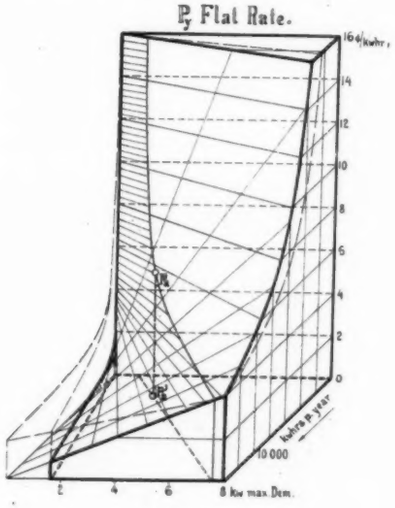


FIG. 8i.

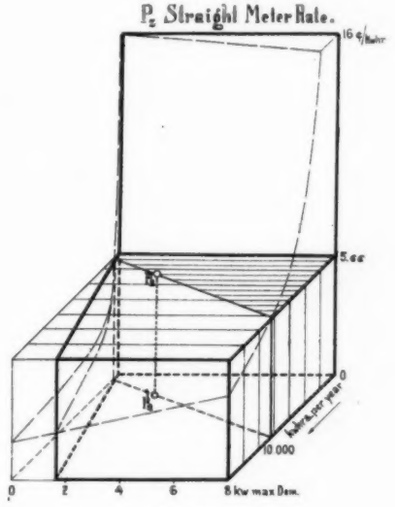


FIG. 8j.

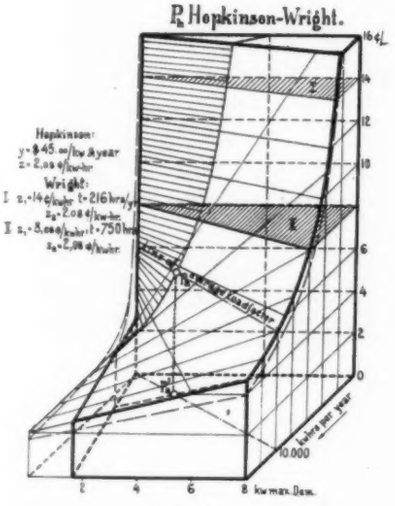


FIG. 8k.

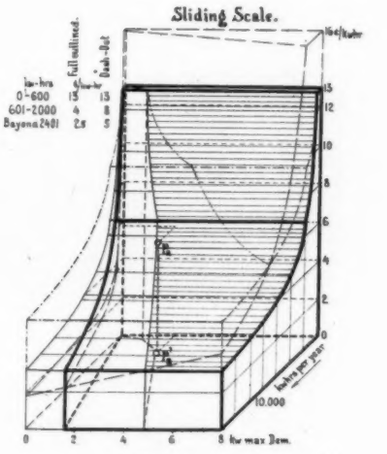


FIG. 8l.

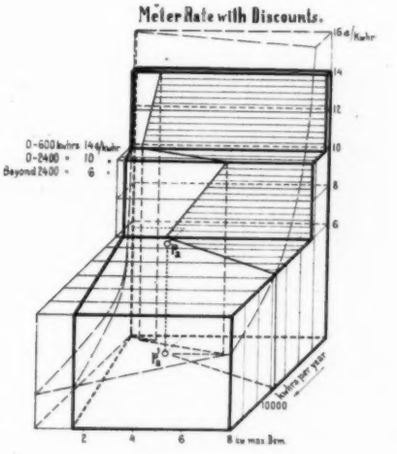


FIG. 8m.

kilowatt-hour charge (Fig. 6), etc.

If P_m is chosen as the straight meter rate point P_z, it is manifest from Fig. 6 that this change of the rates to straight meter rates will always prove attractive to those customers who have a small load-factor and a small energy consumption; the central station using straight meter rates will load itself up with that class of customers and keep many of the large-energy consumers and the long-hour users away by making them either use plants of their own or restrict their use to as short hours and small limits as possible, or use other sources of light and power[13].

In the same way a flat rate will give the station principally long-hour users (particularly such with small installations, Fig. 6) partly because customers who are naturally long-hour users will be attracted, partly because other people will let their lamps burn longer than they would under a more just system of rates.

It can easily be seen that the condition for a customer to be favored occurs when the shifting of the customer's plane parallel to itself involves a "lowering" of this plane nearer to the origin (since the intercept on the X axis equals the amount a of the customer's bill). This shifting can be a lowering only if the *new* rate point P_m is lying "below" the *original* customer's plane (see Fig. 10).

Since the business done with the favored classes of customers, as we have seen, will increase in consequence of the change of rates and for exactly corresponding reasons the business done with such customers as demand an opposite character of service will lose in importance, the service of the average customer will tend to be more and more like that of the favored classes of customers. This means that the central-station plane will have a tendency to turn parallel to the direction of the planes of the favored customers.

13 In consequence of the hitherto prevailing influence of rates working exclusively in the YZ plane it has become an established idea that the customer with a small installation, and the short-hour user are the least desirable ones. With the three charge system, however, which, working in three dimensions is so much more flexible, things are different, and if the rate point is situated at the true rate point P_s every class of customers is equally welcome. If the rate point is not located in the proper place P_s, then, of course, as has been pointed out, a certain class of customers are favored and pay less in comparison to the expenses they cause than others, but this is not of necessity the small and the short-hour customer. If, for instance, the rate point is located somewhere in the vicinity of AB (Fig. 6) it is imaginable that the central station welcomes the small customers with short-hours use more than the others, since the percentage profit is high on their bills.

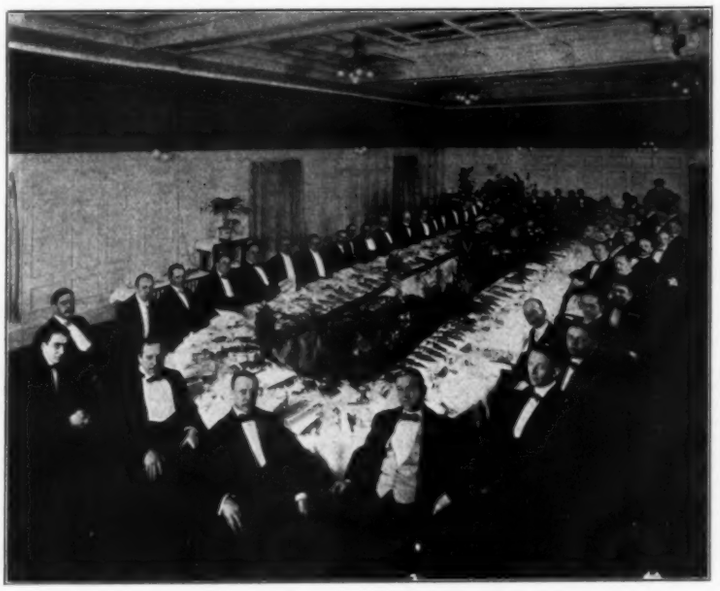
(To be continued.)

Ripening Fruit Electrically.

Among the many uses to which electricity is put, there is none more unique than that of ripening fruit. At Louisville, Ky., a firm of commission merchants found that in the room in which bananas are kept it is necessary to maintain a constant temperature of seventy-five degrees. A dry heat is necessary because of the steam arising from the sweat of the bananas. This tropical fruit is placed in an air tight room about 8 by 10 feet in size and the bananas are ripened through the agency of an electric radiator placed therein. Fruit ripened in this way is said to have an excellent flavor.

An Electric-Vehicle Dinner.

The third annual banquet given to the electric-vehicle manufacturers by the Electric Storage Battery Company of Philadelphia took place on Wednesday evening, February 1, at the Mid-Day Club, Chicago. Herbert Lloyd, president of the Electric Storage Battery Company, and Godfrey H. Atkin, manager of the Chicago office, acted as hosts.



ELECTRIC-VEHICLE BANQUET IN CHICAGO.

Being a storage-battery dinner the guests were assembled as complete elements, the table serving as a vehicle tray. The electrolyte, although neither alkaline nor acid, was of the proper specific gravity to permit of a full charge, so that no lack of electromotive force was noticeable during the entire run.

The Philadelphia Electrical Show.

The second annual Philadelphia electrical show, conducted under the auspices of the Electrical Exhibition Company of America, was opened on Monday evening, February 13, at the First Regiment Armory, with bright promises of a successful two weeks' exhibition.

All spaces are occupied and the show is quite a comprehensive one, embracing exhibits of the heavier apparatus as well as numerous appliances for the home.

Electric vehicles are in evidence in a number of booths, and the educational institutions of the city are represented by the University of Pennsylvania, the Franklin Institute and Spring Garden Institute.

The management has directed much effort towards making the show an artistic one and the results have been highly satisfactory. As one enters the armory there is revealed a scene at night in a sunken Italian garden, the booths being covered with pergolos interwound with vines and electrically illuminated artificial flowers. Extending entirely along the walls of three sides of the hall is a scenic painting representing night on the Mediterranean. The scene is laid near Sorrento, Italy. The roof of the building is draped in dark blue to portray a sky in the depths of which are placed numerous incandescent lamps operated on flashers to represent twinkling stars.

All booths are of a uniform design, with a green floor covering to represent a lawn. Extending down the center of each double row of booths, and as an intersection of each, are white columns, on bronze bases, which support the overhanging pergolas.

At the front intersection of each booth is a handsome bronze urn on a bronze pedestal containing evergreen plants and various species of typical Italian flowers which are electrically illuminated.

Placed under the pergolas, for booth lighting, are about 500 100-watt Mazda lamps equipped with Gillender & Sons' "Micra" translucent reflectors. About 500 fifty-watt Mazda lamps with frosted globes are placed on the outside margin of the pergolas illuminating the aisles.

Each day in the lecture room of the hall Prof. E. G. Wilkinson conducts interesting demonstrations with high-frequency currents, with popular educational demonstrations of the uses of electricity in electro-therapeutics.

Special days have been set aside by the show management, as follows: February 13, Municipal Day; February 14, Franklin Day; February 15, Electric Vehicle Day; February 16, Physicians' Day: Electro-Therapeutics; February 17, Business Men's Day; February 18, University Day; February 20, National Electric Light Association; February 21, New Jersey Day; February 22, Washington's Birthday; February 23, Pennsylvania Electric Association; February 24, Sons of Jove Rejuvenation; and February 25, Students' Day.

Outside the Armory, Broad Street is illuminated by temporary arches of incandescent lamps which span the street and extend from the Armory to the City Hall. At intervals electric signs, advertising the show, are suspended beneath the arches.

The City Hall is especially lighted and has erected on the North Broad Street side an electric sign welcoming the electrical industries. A feature of the advertising the show is receiving is a number of decorative electric floats which are being run over the city's various traction lines.

Credit is due the management for the production of a highly effective show and for efficient handling of exhibits.

The decorative effects were designed and constructed under the direction of Sidney K. Allman.

The largest and the most elaborate exhibit by far is that of the Philadelphia Electric Company which occupies the entire east end of the building. The exhibit is placed upon a raised gallery, inclosed by an artistic white balustrade interspaced with bronze urns and flowers such as are use throughout the entire building. In the center of the booth an electric fountain plays. At each end of the space is built a white Grecian temple and extending the intervening distance is a row of five white columns, each supporting a large glass globe, containing a number of variously colored incandescent lamps, operated on "Skidoo" sockets, which present a kaleidoscope view as the light constantly changes in color.

GENERAL VIEW OF PHILADELPHIA ELECTRIC SHOW, FIRST REGIMENT ARMORY, PHILADELPHIA, PA.

The temple at the left of the span contains an electric shop with the various electrical appliances for use in the home, shown in actual operation.

The temple on the opposite side of span is used as the company's illuminating engineering booth. Here is shown a cabinet arrangement with eight compartments, each with a different unit of illuminant and designed to show the effect of different kinds of light on colors. There is also shown a cabinet, the purpose of which is to show the absorption and reflection of light by various colors.

In the center between the two tem-

ples is the exhibit of the engineering department of the company. Among the many interesting features of this exhibit is a meter-testing rack, on which are installed the various standard types of alternating-current and direct-current meters.

American Telegraph Typewriter Company, New York, N. Y., is showing, in operation, its telegraph outfit which substitutes a typewriter for a telegraph instrument, at the receiving and sending ends. J. F. Stevens is in charge of the exhibit.

Auxiliary Fire Alarm Telegraph Company, Philadelphia, Pa., is showing in operation an exhibit of auxiliary fire-alarm systems for hotels, manufacturing plants, etc. N. McDougald and A. L. Bunting are in charge.

L. D. Berger, Philadelphia, Pa., is exhibiting the Premier electric vacuum cleaner. This machine is shown in operation.

Charles Bond & Company, Philadelphia, Pa., are featuring the "Grundy" patent flexible insulated coupling for electric work. A line of "Veelos" Balata belting is also on exhibition. H. A. Lippincott and H. H. MacFern are in charge of this exhibit.

J. F. Buchanan Supply Company, Philadelphia, Pa., is demonstrating the Hoover electric suction cleaner. A. M. Brehm is in attendance.

Judson C. Burns, Philadelphia, Pa., has on exhibition the Magic electric suction cleaner. This cleaner weighs but ten pounds.

H. B. Camp Company, Pittsburg, Pa., through its Philadelphia office, is showing various sections of its vitrified clay conduits, in single and multiple duct. E. E. Nickson, manager of the company's Philadelphia office, is in charge.

Capitol Turbine Company, Philadelphia, Pa., has on demonstration a number of Capitol suction cleaners.

City of Philadelphia's electrical bureau, under the direction of Chief McLaughlin has an interesting working exhibit which shows in operation the electrical appliances such as are in use by the city.

Columbus Buggy Company, Columbus, O., has on exhibition two "Columbus" electric coupés. Harry Selzer and E. B. McCown are in attendance.

Commercial Truck Company of America is showing one of its panel type electric delivery wagons of 1,000 pounds capacity. E. Hare is in charge of the booth.

E. B. Day, Philadelphia, Pa., representing the Century Electric Company, St. Louis, Mo., and the Richmond Electric Co., Richmond, Va., has on display a line of Century single-phase alternating-current motors and Richmond two and three-phase alternating-current motors in various sizes. E. B. Day, G. H. Pechin and C. H. Seitz are in attendance.

The Edison Storage Battery Company, Orange, N. J., is showing various types of its storage batteries for ignition and lighting purposes, for commercial and pleasure vehicles, railway train lighting and yacht lighting. On a board are mounted all the different parts that go to make up this battery from the raw material to the finished product. H. L. Davisson and W. H. Plaisted are in attendance.

Electric Storage Battery Company, Philadelphia, Pa., is exhibiting a full line of storage batteries ranging in size from the small sparking batteries to the largest type of central-station battery. A feature is the "Iron-Clad Exide" for electric-vehicle use. A type of the cell used by the Philadelphia Electric Company and other lighting companies is shown and also a cell such as is used by the Philadelphia Rapid Transit Company. The Company shows a complete line of plates, grids and storage-battery accessories, together with the "Hydra" low-voltage lamps for motor cars and motor boats. A model of a submarine boat, with a rubber jar such as used by the United States Navy in its submarine boats, attracted attention. Messrs. Reynolds, Ehrlich, Adams and Smith represent the Company.

Engineering Equipment Company, Philadelphia, Pa., exhibits a line of circuit-breakers in both oil and carbon break (the oil for alternating-current and the carbon for direct-current) and a line of shop-lighting fixtures both for cluster and single light. Joseph P. Manypenny is in charge of this booth.

Federal Sign System (Electric), of Chicago, Ill., is featuring its "automatic" kitchen cabinet consisting of a motor-driven coffee grinder, meat chopper, dough mixer, flour sifter, etc., mounted in a model cabinet. Other features are the ozonizer manufactured by the company, tungsten fixtures and clusters, Federal shaving mirrors, Federal vacuum cleaner, and its regular line of porcelain enameled steel signs, flasher signs, etc. A. R. Dean, L. F. Bruce, W. W. Tower and H. I. Markham are in attendance.

V. V. Fittings Company, Philadelphia, Pa., is showing a complete line of Burns patented conduit fittings.

Franklin Institute of Philadelphia is showing in bound volume form a complete set of the *Journal* of the Institute since 1824.

Flexlume Sign Company, Buffalo, is exhibiting a line of "one lamp a letter" "Flexlume" signs in various sizes. W. S. Wright and G. Hoch are in attendance at the booth.

Fort Wayne Electric Works, Ft. Wayne, Ind., is exhibiting a line of horizontal and vertical direct-current motors, its series-tungsten street lighting system and a complete line of fractional horsepower motors for both alternating and direct current. There are also shown alternating-current and direct-current desk and bracket fans, a pedestal motor-driven buffer, motor-driven air compressors, single and multiphase watthour meters, an electrically driven rock drill, alternating-current compensarc, and bell-ringing transformers. The Company is represented by A. H. Boyd, E. W. Lithgow, C. P. MacGonigal, C. H. Stanton, C. A. Woolsey, E. H. Porter, J. B. Coghill and W. S. Martin.

General Electric Company is exhibiting motors for household and factory use, including the sewing-machine motor in operation, as well as the buffing and grinding outfits. All sizes and types of incandescent lamps shown including the 500-watt lamps with Monolux fixtures and shades, and the drawn-filament train-lighting lamps. Arc lamps for office, store and factory lighting prove of great interest. The new type spot lamp, known as the G. E. Lens lamp, is also shown as well as a very complete line of heating devices, including the domestic range, percolators, chafing dishes, disk stoves, heaters, etc. An auto lighting equipment is also of interest. This outfit consists of a special lamp and socket that may be easily adjusted to fit any gas or oil, head, side or tail lamps.

General Vehicle Company, Long Island City, N. Y., is showing a 700-pound capacity, all-metal-type body, delivery wagon which was designed in accordance with a demand voiced by central stations for a wagon of this size. A General Electric mercury-arc rectifier for charging is also exhibited in this space. W. W. White is in charge of this exhibit.

Gillinder & Sons, Inc., Philadelphia, Pa., are showing an attractive line of their new "Micra" translucent prismatic reflectors, and their different styles of cut, etched and decorated illuminating glassware. F. R. Gillinder, Jr., and Howard S. Beatty are in attendance.

Gudeman & Company, New York, N. Y., are exhibiting various types of electrically illuminated flower decorations, imitating closely the natural flowers; artistic electrical table decorations for various purpose are also shown. All the electrical flower decorations throughout the building were furnished by this Company under the direction of Leo Gudeman who is in charge of the Company's exhibit.

International Correspondence Schools of Scranton, Pa., has on exhibition a complete line of its electrical publications. J. H. Martin is in charge of the booth.

Invincible Renovator Sales Company, Pittsburg, Pa., is showing in operation its portable and stationary electric vacuum cleaners. Q. P. Stahlman is in charge

Keller Manufacturing Company, Philadelphia, Pa., is demonstrating in operation the Santo electric vacuum cleaner. To show the endurance of this machine, one is being subjected to a severe test, running continuously without intermission, during the open hours of the show. Included in this exhibit is also shown one of the Company's stationary machines. C. J. McManus, C. C. White, R. E. McCann and Roland Hill are present.

Keystone Telephone Company, Philadelphia, is showing a working exchange of 160 lines capacity. Through this exchange free service is furnished to each exhibitor by the Company. Various telephone sets, switchboards and meter instruments, etc., are also shown in this exhibit.

Kinetic Engineering Company, Philadelphia, Pa., is showing its organ blower operating on both alternating-current and direct-current. H. A. Bierck, J. G. Bierck and Joseph Why are representing the Company.

Lewis-Roth Company, Philadelphia, Pa., is exhibiting a complete line of Fairbanks-Morse motors, generators and gasoline-electric country-lighting sets; Hazard Manufacturing Company's wires and cables; The Morgan Crucible Company's "Morganite" and "Battersea" carbon brushes and American transformers. The Company is represented by R. Roth and L. R. Lewis.

McCrum-Howell Company, New York and Chicago, occupy five spaces in the center of the building and make a very attractive display of "Richmond" vacuum cleaning machines, both of the stationary and portable types. Several "Richmond" suction cleaners or portable machines are shown in operation. The machine attracting the greatest attention is the silent "Richmond" No. 11, a one-horsepower direct-connected outfit of the rotary-pump type. F. C. Allen is in charge.

National Carbon Company, Cleveland, O., is showing a line of its dry cells, flaming-arc carbons, carbon brushes, electrodes, and searchlight carbons; a feature shown is the Company's multiple battery for automobiles and motor boats. W. T. Conn, J. E. Roberts and A. B. Pyke are in attendance.

Nernst Lamp Company, Pittsburg, Pa., is showing various types of Westinghouse Nernst lamps, together with fixtures adapted to their use. Samuel Stevenson, manager of the Philadelphia branch, is in charge of the exhibit.

H. T. Paiste Company, Philadelphia, Pa., is featuring its line of pipe taplets of from one-half to one and one-half-inch size, which are mounted on a turnstile. This turnstile when revolved lights up 150 lamps mounted on the frame of the turnstile. Also shown in this booth is a full line of the Company's 750 manufactured appliances. In attendance are W. T. Thomas, E. Jenkins and W. W. Winship.

Pennsylvania Storage Battery Company, Philadelphia, Pa., has on display a line of portable fans which operate on a wet cell with a capacity of fifty hours life. There is also shown a line of "Hirsch" storage batteries for lighting, sparking and various other purpose. In attendance are H. H. Hirsch, L. Hirsch and H. S. Marks.

Philadelphia Electric Company is showing in operation, in a special booth, the following: A Hughes electric cookstove manufactured by the Hughes Electric Heating Company, Chcago; a "Thor" electric washer manufactured by the Hurley Machine Company, Chicago; a "Quad" electric fireless

cooker manufactured by the A. L. Sykes Manufacturing Company, Cincinnati; and a "Quartzalite" oven made by the Simplex Engineering Co., Philadelphia, Pa.

Philadelphia Electrical Contractors' Association occupies a row of three booths which is used as a reception room, where visitors to the show are cordially received.

Philadelphia Rapid Transit Company is showing in operation a miniature railway, which is operating the standard elevated-type electro-pneumatic signal, with standard alternating-current track circuits. This exhibit represents the Company's loop at Sixty-ninth Street and a portion of the elevated. Occupying the center of the booth is an electrically illuminated instruction board such as is used by the Company for instruction of its motormen on the proper operation of the cars.

Philadelphia Storage Battery Company, Philadelphia, Pa., is exhibiting its line of "Philadelphia" storage batteries, including the types used by various electric-vehicle manufacturers. Mounted on a panel are shown a complete line of the Company's "Diamond" plates and grids. Another panel shows the line of storage-battery accessories manufactured by the Company. Lighting, signal and ignition batteries are also on display in the exhibit. F. S. Marr, Edward Davis, E. E. Everett and Mr. Mulcey are in attendance.

Printograph Sales Company is showing the "Printograph" power typewriter in operation.

Rider-Ericsson Engine Company, through its Philadelphia office, exhibits in operation, its "Recco" water system, and also a Recco centrifugal pump. D. M. Emery and H. L. Shartle are in attendance.

Rosmassler-Bonine Electric Company, Philadelphia, Pa., shows a line of small direct-current motors and generators. H. T. Lewis is in charge of the exhibit.

Simplex Electric Heating Company, Cambridge, Mass., is featuring a complete new line of chafing dishes and percolators in the latest designs. There is also displayed a complete line of new electric household irons ranging in weight from three to nine pounds, together with electric toasters, waffle irons, curling irons, an electric range, and a full line of the heating appliances manufactured by the Company. The company is represented by E. B. Stebbins, H. F. Holland and George T. Dold.

Spring Garden Institute is exhibiting numerous apparatus made by the students. The students are also conducting a number of interesting experiments with high-frequency current. The exhibit is in charge of Harry N. Stillman and Howard W. Gross.

Straight Filament Lamp Company, New York, N. Y., is showing a line of its tube lamps, illustrating their adaptability to store-window lighting and theatrical purposes. Owing to its ability to withstand vibration the lamp is also well adapted to factory lighting. W. S. McCartney and R. P. Breese represent the Company.

Studebaker Brothers Company of New York has an exhibit of two pleasure vehicles, one of them a victoria and one a landaulet, together with a commercial delivery wagon of 850-pound carrying capacity. H. De Groat, manager of the Philadelphia branch, is in charge.

Thordarson Electric Manufacturing Company, Chicago, Ill., is showing a line of its laboratory and experimental apparatus. Popular high-frequency demonstrations are being given, including the frying of eggs over a sheet of ice, operation of wireless egg beaters and wireless churns, etc. The demonstrations are conducted by Foster Callaghan, who is representing the Company at the show.

University of Pennsylvania distributed literature describing its various courses and exhibited illuminated photographs of its various class rooms, laboratories, etc. A feature of the exhibit is a large frame containing numerous etchings of Benjamin Franklin.

Waverly Company, Indianapolis, Ind., is exhibiting the high-speed Waverly roadster which made the trip from Philadelphia to New York at an average speed of twenty miles an hour. This vehicle is equipped with the Edison storage battery. George A. Fort is in charge of the exhibit.

Van Houten & Ten Broeck of New York are showing a line of electrotherapeutic apparatus, including a bath cabinet, two static machines, a Rumkorf coil, small coils, and batteries, and a thermo-penetration outfit. A 500-candlepower therapeutic lamp is also shown together with a number of small hand lamps. Prof. E. G. Wilkinson and Dr. L. R. Newbold are in attendance.

The Westinghouse Electric & Manufacturing Company featured its new adjustable-speed alternating-current mill-type motor. These motors are shown partly dismantled, so one could see their heavy rigid construction. Among the other industrial motors were shown several sizes of the type "S," types "SA," "CCL," and "HF" motors, together with control apparatus for each type of motor. The Westinghouse general utility motor was exhibited, with a motor shown for every application for which these motors are designed. Among other features of the Company's exhibit were several models of new 1911 fan motors, which included twelve and sixteen-inch mechanical oscillating fan motors for either wall or desk mounting, as well as a new twelve-inch exhaust fan motor for ventilating purposes. Other pieces of apparatus in the exhibit included representative pieces of heating and cooking devices, battery-charging rectifier, portable and switchboard meters, lightning arresters, and a great variety of other electrical apparatus.

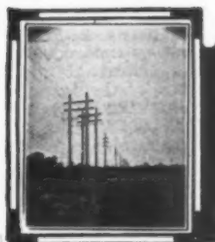
Westinghouse Lamp Company is showing a very complete exhibit of all sizes of new wire-type tungsten lamps, ranging in size from twenty-five watts to 500 watts, for both 110 volts and 220 volts. Street-series tungsten lamps, sign lamps, train-lighting lamps were also shown in different sizes and voltages. Among those in attendance at the Westinghouse exhibit were John J. Gibson, V. E. Cohen, Thomas Cooper, H. M. Gansman, B. Hayllar, H. L. Vogel, R. F. Moon, C. V. Woodward, M. Henoch, Burt Bay, S. H. Dannatt and L. T. Peck. The exhibit was in charge of W. Barnes, Jr., of the Westinghouse Department of Publicity, East Pittsburg, Pa.

Williamson Company, Philadelphia, Pa., is showing a switchboard equipped with instruments, circuit-breakers, etc., manufactured by the Roller-Smith Company, a line of Allen-Bradley motor starters for both alternating and direct-current and a number of Columbia meters. H. C. Clayton, W. R. Baylie and Charles Shay represent the Company.

Woods Electric Garage of Philadelphia, Pa., is showing a Woods electric victoria, manufactured by the Woods Motor Vehicle Company, Chicago, Ill. This is a machine of standard equipment and which made 159 miles on a single charge. J. C. Bartlett and W. H. Metcalf are in attendance at the booth.

NIGHT VIEW OF BROAD STREET.

SPECIAL ILLUMINATION OF CITY HALL.



CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

ELEMENTS OF POWER-STATION DESIGN.—XXIII.

STORAGE-BATTERY PLANTS.

BY W. B. GUMP.

While the storage battery has a number of objectionable features, its uses have continually extended and at the present time few large power systems are complete without a storage-battery equipment, either at the generating station or at one or more points of distribution. The present treatment will take up the application of the storage battery to power-station work, including its use in connection with boosters, and giving the chief details to be observed in planning battery installations, with particular reference to constructive features.

A storage battery, secondary battery, or accumulator, is an electrochemical apparatus, through which a portion of the electrical energy previously expended may be returned to the system when needed. The most common form of storage battery consists of lead plates immersed in a solution of diluted sulphuric acid, each cell being contained in a glass jar or lead-lined wooden tank.

The term storage battery is misleading, from the fact that in it electricity is not stored. Its energy merely takes another form. Upon charging the battery the electrical energy is converted into chemical energy, and upon discharging, this energy is converted back to electrical energy. It is, therefore, a process of conversion, and the cell is virtually a converter in the sense that it is a medium through which this transformation takes place.

The chief uses of the storage battery are:

(1) Power-station use for reserve capacity, regulation, emergency service.

(2) Traction and vehicle purposes.

(3) Telephone and telegraph service.

(4) Train lighting.

(5) Signal service.

(6) Boat propulsion.

(7) Laboratory and experimental work.

Since item (1) only is to be embraced in this discussion it will be divided into the following subheadings:

(a) Characteristics of the storage cell.

(b) Application of batteries to isolated plants.

(c) Floating batteries.

(d) Battery operation without boosters.

(e) Battery operation with boosters.

(f) Design and construction of battery plants.

(g) Care and maintenance.

(*a*) *Storage-battery characteristics.*—The inherent workings of a storage cell have never been completely analyzed, and the exact chemical changes which take place are not known, though the theory of the action has been fairly well settled. Only the fundamental principles of the commonest type of storage cell will be dealt with here, since space does not permit a discussion of the chemistry of the case, and this belongs more properly to a treatise on electrochemistry.

When two lead elements are immersed in a solution of dilute sulphuric acid (H_2SO_4) and a current is made to pass through these elements for a long period of time, a chemical change takes place, one element becoming positive and the other negative. If the charging current is stopped, and the battery is connected to a circuit, energy is reproduced in the form of an electric current, flowing opposite in direction to that of the original charging current. During the process of charging the cell, one of the lead elements is transformed to lead peroxide, while the other is changed to porous or sponge lead. The first is termed the positive plate, and the latter the negative. On discharging the cell a reverse chemical process occurs, tending to bring the lead plates to their original condition.

When fully charged, the density of the electrolyte is at its maximum, which should be about 1.2. As the battery discharges, its density continues to decrease, until it reaches a density of about 1.15 to 1.135, which latter is the lowest point that a station battery should be allowed to reach in practice. Observe the upper curves in Fig. 1, showing the variation in density with reference to the time in hours.

The potential variation indicated in the lower curves shows that the voltage at the beginning of charge increases rapidly from about 2 volts to 2.2 volts, after which its increase is more gradual until the end of charge, where it again rises rapidly. On discharging the voltage falls, as seen in the lower curve.

The usual method of rating a storage battery is on a basis of ampere-hours, the normal length of time of discharge being eight hours.

The method of rating for different periods of time is approximately as follows:

Discharge rate of 8 hours $= X$ amperes, or 8-hour rate.

Discharge rate for 3 hours $= 2X$ amperes.

Discharge rate for 1 hour $= 4X$ amperes.

Discharge rate for 20 minutes $= 8X$ amperes.

Efficiency.—The efficiency of a storage battery is necessarily the same as the efficiency of any other piece of electrical apparatus, and is equal to the watt-hours output, divided by the watt-hours input.

A battery is sometimes reckoned on the ampere-hour efficiency, which shows a higher figure than the watt-hour efficiency. This is due to the fact that the ampere-hours do not take into consideration the potentials, either in

charging or discharging. Hence the true energy is lost sight of.

The watt-hour efficiency of a storage battery, when based upon a discharge to 1.8 volts per cell, may be nearly eighty per cent. A higher efficiency is obtained from a battery which floats on a system and never fully discharges, that is, where the load fluctuations are rapid, and the current is comparatively small. In such cases the efficiency may reach ninety-two per cent.

A lead storage battery should never be allowed to discharge below 1.8 volts per cell on a normal discharge. This is on account of the fact that the lead sulphate which forms on the plates gradually becomes denser, preventing more and more the passage of current and permanently reducing the capacity of the battery. When sufficiently dense, this sulphate is a white substance and is almost a perfect non-conductor. If any considerable quantity of it is permitted to form, it is apparent that great difficulty is experienced in bringing the battery back to normal condition, since the current cannot be made to flow through the sulphated portions. Sulphating is a very common symptom of deterioration, and can be seen in almost any vehicle battery which has not been used carefully.

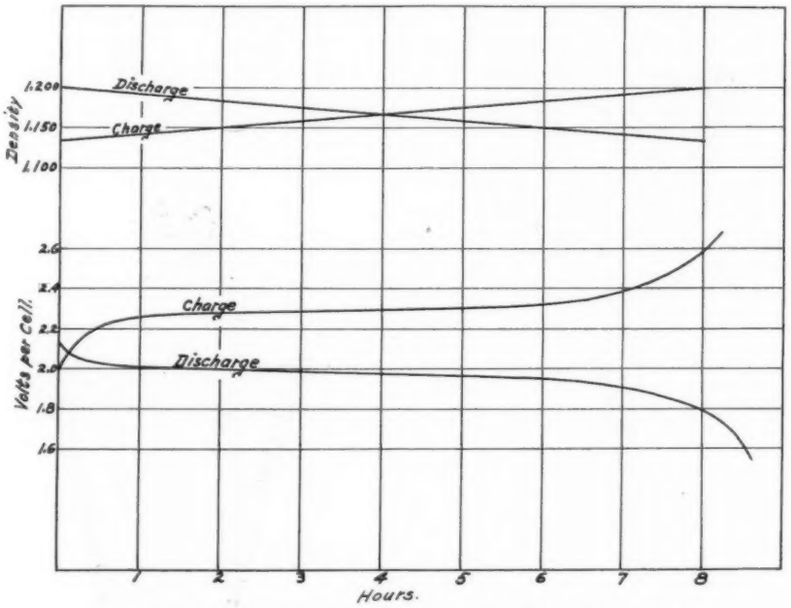


FIG. 1.—CHARACTERISTIC DENSITY AND VOLTAGE CURVES.

(*b*) *Application of batteries to isolated plants.*—In many isolated lighting plants a storage battery may affect a material saving in operating expenses. Such cases are those in which the plant operates only a portion of the day, or else has a very small load most of the time. The lighting load is a peak which demands considerable energy during a comparatively short period.

It is evident that the generating equipment for a plant of this kind, if considered alone, would require a capacity based upon the peak load. With the addition of a storage battery, the size of the generating equipment may be greatly reduced, since only a little over the average daily load need be considered. This average load would be much below the average of the peak itself, thus giving ample opportunity to charge the battery at a low rate and allowing the latter to carry part of the peak and all of the past-midnight load. All machinery would be shut down during the latter period.

A typical case will make this clear. Consider a plant used almost exclusively for lighting and whose day load is only about ten per cent of its evening peak; assume that the maximum load is 225 kilowatts and that the load during the lighting period (from 5 to 12 p. m.) averages 150 kilowatts for the seven hours.

The generating equipment without a battery would require a capacity of at least 225 kilowatts; for eleven hours it would operate on less than ten per cent of maximum loads; for six hours after midnight it would have only three to five per cent of maximum load. A large and a small engine would evidently be needed. With a battery the size of the generating equipment is very much cut down. Thus if the engine is to operate for eighteen hours, only an eighty-kilowatt generator is necessary. If the engine is to run only fifteen or twelve hours a somewhat larger battery and generator are needed. In any case, the generating unit operates at full load throughout. If no battery were installed, two engine units would be needed as well as nearly three times the boiler equipment, if steam were used. However, if the engine shuts down for six to twelve hours, a reserve unit is not necessary, since the battery could be made to take the load during a breakdown. Even if it is advisable to employ a reserve unit, both units will be greatly reduced in size, as compared to the aggregate of those required without a battery.

The possible saving to be considered in a plant of this nature requires very careful analysis. It will sometimes be found that the first cost is higher when considering the battery, than in a plant of the same output without a battery. The annual interest charges and operating expenses added together should always be less with the battery than without it. Otherwise the battery would be an unnecessary addition, except for purely emergency purposes.

In the plant just considered the boiler equipment is reduced over sixty-seven per cent. The engine capacity is reduced to the same extent. This means both a low first cost and decreased maintenance charges on the generating equipment. Against these advantages there are: first, a specially constructed battery-room, containing an expensive battery, and hence an increased cost of the building; second, added maintenance on the battery.

(*To be continued.*)

Improving an Argentine Plant.

The Rosario Electric Light Company, a British corporation at Rosario in the Argentine Republic, will spend over $1,000,000 improving and extending the service. A new plant will be constructed to be completed this year and capable of producing 30,000 horsepower. It will be equipped with modern turbo-generators. New cables will be laid to the most important suburbs.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

BRITISH PRACTICE IN THE CONVERSION OF STREET GAS FITTINGS.

BY FRANCIS H. DAVIES.

In England the present is a time of great activity in street-lighting matters. Competition between the gas and electric-lighting interests has never been so keen, and although the former have achieved a measure of success with high-candlepower units in competition with the arc they are steadily losing ground to the tungsten lamp in low-candlepower and side-street lighting. The determination with which the fight is being carried on lends more than ordinary interest to the methods adopted by the electric-light companies, which, so far as incandescent lighting is concerned, are exemplified by the accompanying illustrations.

FIG. 1.

In almost every case it is not a question of installing new posts and fittings complete, but rather, one of converting gas posts and lanterns. The latter are seldom well designed from the illuminating point of view, but as prices are so cut and economy is the order of the day it is in most instances necessary to retain as much as possible of the gas equipment and so minimize capital expenditure. Hence, a very considerable demand has sprung up for conversion fittings, of which the illustrations are typical.

FIG. 2.

Fig. 1 represents what is probably the earliest type of conversion fitting. It was first used in Brighton some twelve or thirteen years ago, and it is still one of the most popular and effective arrangements. The reflector, which is supported on a rod fitting into a socket as shown, is double concave and made of enameled or painted zinc. According to taste it may have either a bright or a white matt surface, although from the lighting point of view the latter is certainly preferable owing to the improved distribution of light which results. It is customary in some cases to whitewash these reflectors periodically, and this course is quite efficient and cheaper and quicker than painting. The enameled reflector possesses the advantage of retaining a good surface for a longer time and it looks better in daylight, but otherwise it is not so effective and the matt surface is more frequently used. With this fitting the conversion commences at the top of the post which is capped by a socket carrying the switch and four-armed frog. The ends of these arms are slotted in such a manner as to allow of considerable variation in the fixing studs of the lantern, and thus any of the very numerous makes and types can

FIG. 3.

be accommodated. In effecting the conversion the gas lantern is first removed from its own frog, which latter is then taken down and replaced by the socket, switch and special frog. The original lantern is then fixed to the latter and the internal fittings are wired

FIG. 4.

up and put into position. Under no circumstances can the interior fittings be erected out of vertical line with the lantern, the ugly effect of which has to be particularly guarded against in all conversion work.

Fig. 2 shows another very general pattern and one which is better suited to the tungsten lamp. The Y-piece which is shown carrying the lamp holders in Fig. 1 is inverted, and the reflector, also of the double-concave type, is supported by a projection from its top. It is equally impossible for this fitting to be erected, or to get out of line, and on the whole it makes a very neat job. In some cases the lamps are carried higher than shown in the illustration with the result that no part of the cap or holder is visible. This is generally considered an improvement from the illuminating point of view, and the appearance is certainly better.

Figs. 3 and 4 illustrate two types somewhat similar to each other, but quite different from the foregoing. They are used where it is especially desired to concentrate the light up and down the street, and in this the elliptical silvered-glass reflectors are very successful. They are of the type which consists of a double wall of glass silvered inside and sealed up so as to be airtight. Fig. 3 is used in connection with tungsten lamps only, and Fig. 4 is designed for tantalum or low-candlepower lamps. The diagram, Fig. 5, shows the results obtained with this latter reflector when fitted with two 16-candlepower lamps. The design is such that the efficiency of lighting is increased about 200 per cent as compared with a lantern having no reflectors. It will be seen from the diagram that the two 16-candlepower lamps, instead of giving a mean of 32 candlepower, give a maximum of 80 and a minimum of 32 candlepower, or a mean of about 60 candlepower. In order to understand how the employment of properly designed reflectors of suitable sizes can produce such results, it is only necessary to remember that in street lighting with plain lamps and no reflecting surface, all the light rays directed above the horizontal and most of those falling into the half of the lower hemisphere occupied by houses and land adjacent to the footpath, are wasted. In other words, when the source of light gives a practically even spherical illumination the upper hemisphere and about half the lower hemisphere are wasted unless suitable reflectors are employed. The best weapon of the electric-lighting interests is the reflector, which, owing to the heat and corrosive effect of gas cannot be utilized effectively by their opponents. This is now thoroughly realized, and hence reflectors are playing a very important part in the battle between the two systems of lighting.

FIG. 6.

In Fig. 6 is illustrated a three-light conversion fitting designed for central positions where a comparatively high-candlepower is required. It is very effective, and there are a large number of these and similar types in use. The spun-metal hood and reflector are carried on a piece of pipe which is attached to the top of the switch box by means of a socket and nipple. This pipe does not cast a shadow as it is so placed as to coincide with one of the corners of the gas lantern. The same fitting may be used without the lantern. It is frequently used in this form with a sin-

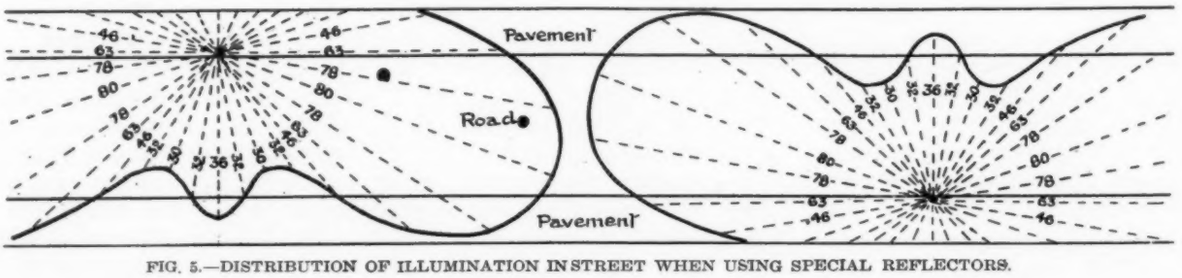


FIG. 5.—DISTRIBUTION OF ILLUMINATION IN STREET WHEN USING SPECIAL REFLECTORS.

gle lamp, as the construction of the hood renders the whole absolutely water-tight.

In the course of a short article it is impossible to illustrate or even to mention more than a few of the leading and most characteristic methods of conversion. Most of the best class of fittings have been dealt with above, but there remain many others of a comparatively rough and ready nature which are in extensive use in the less important towns.

A good instance is afforded by one large suburb of London throughout which the bulk of the gas lanterns have been converted by the simple expedient of removing the burner and fixing internally across the top of the lantern a piece of wood from which a tungsten lamp is suspended. Lead-covered wiring is run in one of the corners of the lantern, and the whole job is as cheap and simple as possible. No reflectors are used, the ordinary white opal top panes of the lantern serving very well instead.

In another method the gas lantern and frog are removed entirely and their place taken by a curved piece of barrel terminating in a plain enameled-iron circular reflector. This latter is not of the ordinary conical shape, but is disned at the center, and is fixed to the iron barrel in such a manner that it entirely covers the lamp socket. The lamp is unprotected, but the arrangement is quite water-tight.

Portable Electric Lamps for Mines.

Substantial progress is being made in Europe in the use of portable electric lamps in mining. No less than eight firms are now manufacturing more than seventeen varieties of these lamps in Germany alone. The entire German outfits, including the lamps proper, and the lead accumulators which furnish the power, ordinarily weigh only 2.4 to 6.2 pounds. The different lamps burn from 4.5 to 23 hours. The cost of maintenance has been estimated at about five cents per kilowatt-hour.

The widest use of these lamps at present is in mine-rescue undertakings. Some of the lamps, however, are adapted to general mine work; and investigations now in progress will greatly extend the last mentioned application of these conveniences.

New York Section, Illuminating Engineering Society.

The unusual happened at the meeting on February 9 of the New York Section of the Illuminating Engineering Society, for the attendance was double that of the usual number. The meeting was preceded by a beefsteak dinner at the Castle Cave Restaurant, which may account for the gathering numbering nearly 100.

Needless to say the various speakers were in a happy vein in keeping with their appearance in aprons. A. H. Elliott, the chairman, called upon Henry Hornbostel, whose topic was "Light and Architecture." His remarks included the architect's troubles, the last being the lighting-efficiency engineer. He showed that the general public is just beginning to realize the possibilities of artificial lighting and in the greatest effects so far obtained such as in motion-sign lighting the question of efficiency was not considered at all. He predicted that the lighting fixture is doomed to go as improvements in light sources continue.

Mr. Barber brought out most agreeably, but forcibly as well, the fact that, even though the public takes many things of great magnitude for granted, the engineers should endeavor to produce results which would be of a more permanent character and he cited many instances of buildings costing millions with a life of less than ten years.

Bassett Jones stated that buildings must be lighted to be seen, and to be seen correctly they must be lighted correctly. It is the function of the architect to conceive and of the illuminating engineer to execute the lighting effects. Both have their field and by the very nature of things the time is coming when the architect will hand this portion of the work to others just as he has other portions.

Mr. Moore spoke of the advantage of large sources of low intrinsic brilliancy. Others entering the discussion were Messrs. Elliott, Holden, Lansingh and Voorhees.

The next meeting will be preceded by an inspection of the lighting in Gimbel Brothers' large department store. A paper on this subject will form the chief topic of the meeting, which will be held on March 9, and should prove very interesting.

Illuminating Engineering Convention in Chicago.

The Council of the Illuminating Engineering Society has accepted the earnest invitation of the officers of the Chicago Section and of several Chicago civic and technical bodies to hold the next annual convention in Chicago. The convention dates have not yet been determined, but will probably be in the latter part of next summer or early in fall.

Publication of Lectures on Illuminating Engineering.

It is announced by Johns Hopkins University that orders for the lectures which were delivered last fall in connection with the convention of the Illuminating Engineering Society should be received before March 15. The lectures fill two volumes and the price has been fixed at $4.00, by subscription only.

Hydroelectric Enterprise in Brazil.

The Rio de Janeiro Government has resolved to grant the Bracuhy Falls and Metallurgical syndicate the rights for the exploitation of the hydraulic force of the falls of the River Bracuhy, in Angra dos Reis, to be applied to the development of various industries, but especially mining and the manufacture of iron.

The Falls of Bracuhy are 880 meters in height; and the estimate of power available, without dams, gives 24,000, and with dams, 100,000 horsepower.

This new establishment is to be erected in Angra dos Reis, in the south of the State, near the property of the Compagnie Sucriere d'Angra.—*Brazilian Review.*

Detection of Tungsten.

The principal minerals of tungsten are tungstates of iron, manganese and calcium; more rarely of lead. Tungsten trioxide is a bright yellow powder, which is almost insoluble in hydrochloric or nitric acids; hence by boiling the suspected mineral with hydrochloric acid, the presence of tungsten may be detected by the appearance of the bright yellow precipitate. With the addition of metallic tin or zinc the trioxide is further reduced, the lower oxides showing successive colors of blue to brown.

TELEPHONY—TELEGRAPHY, and WIRELESS.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION.

ANNUAL CONVENTION IN CHICAGO, FEBRUARY 8, 9 AND 10.

The fourteenth annual convention of the National Independent Telephone Association was held at the Hotel La Salle, Chicago, on February 8, 9 and 10. The convention was one of the most successful ever held by the Association and in point of attendance alone was practically unequalled, there being over 500 delegates registered. The exhibits of telephone, supply and manufacturing companies occupied the seventeenth and eighteenth floors of the hotel. The convention sessions were held in the two large banquet halls on the nineteenth floor. As usual the convention concerned itself mostly with questions of public policy in the telephone industry and rather less attention was given to the technical details. A number of technical conferences, however, were held, at which the latter features received some consideration.

The first session of the convention was opened by President Frank H. Woods, of Lincoln, Neb., on Wednesday morning. Assistant Corporation Counsel H. W. Hayes, of the City of Chicago, on behalf of Mayor F. A. Busse, welcomed the Association to the city. In speaking of competition, he referred to the telephone system of the Illinois Telephone & Telegraph Company, which is now being completely rehabilitated, and is already in operation, although the company is not under obligation to begin service until June 1, when 20,000 telephones are to be in use. On behalf of the city he thought that this new telephone system was going to prove of great value in bettering the telephone service in Chicago. He also referred to the Chicago Telephone Company's appeal to allow a sufficient surplus in order that it may fight this authorized competition of the Independent company.

In responding on behalf of the Association, Judge N. G. Hunter, of Wabash, Ind., paid an eloquent tribute to the greatness and progress of Chicago. He said that the completion of the new Independent system in that city will bring connection with over 1,000,000 telephone stations within a radius of 200 miles during the next year. These Independent stations have not yet enjoyed communication with the western metropolis. Judge Hunter stated that the Independent movement in telephony represents now about 4,000,000 stations as a result of a growth of less than fifteen years. The Independent interests as heretofore seek only fair competition and a fair opportunity to conduct their business. In order to combat the efforts of the vested interests he advised the Independent men that they "must hang together or hang separately."

The annual presidential address was then read by President Woods.

Mr. Woods' address was concerned principally with questions of public policy. He stated that the Bell interests had originally allowed competition in the telephone field, but later they had sought to stifle it. In a large part of the field, however, telephone competition is still rife. He believes that the Bell companies realize that they cannot control the field absolutely and therefore they no longer insist on the exclusive use of Bell instruments in interchange contracts. Whereas most trusts and monopolies have grown out of competition, the telephone industry has grown out of monopoly. Mr. Woods dwelt at length upon the control of public utilities by state commissions. The commission form of regulation he regarded as best when adequate powers are given to the commission. Twenty-two states have already established public service commissions with fairly broad powers. The Interstate Commerce Commission has just taken hold of the interstate-telephone business and all things point to a considerable extension of commission control. Its results have been satisfactory in practically all instances and therefore he recommended that commissions be established in those states that have not yet done so. Readjustments of rates are frequently needed, but they can not be obtained equitably to both interests except through a commission. Commissions make the stock and bond issues of companies reliable. They can regulate standards of service and control telephone rates. Taking up the question of physical connection of all telephone lines, Mr. Woods pointed out that through it alone can universal telephone service be attained. Independent telephone lines have been quite commonly combined to permit extensions of toll service, but in some localities it is practically impossible to establish exclusively Independent lines. Independent telephone men have always been willing to accomodate the public. The public now demands physical connection of all telephone lines. The Independent companies should, therefore, appeal to the commissions already established and to the legislatures of states where they have not yet been formed to compel physical connection by law. He cited the case of La Crosse, Wis., which has thirty-two private branch exchanges connected to both the Bell and the Independent systems. The value of a telephone depends upon the number of subscribers that can be reached by it and this applies both to the toll and local service. Compulsory physical connection of competing lines permits the local interests to decide on the kind of service to be given locally, whether it shall be manual or automatic, common-battery or magneto. There are no legal reasons against physical connection. The Bell interests were formerly against it unless it was to their profit. In conclusion Mr. Woods favored the adoption of measured and limited service, and again calling attention to the advantages of commission control in the telephone field he mentioned the $350,000.00 now invested in Independent telephone companies, which deserves adequate protection by the government authorities.

Secretary-Treasurer J. B. Ware, of Chicago, then summarized his annual report in which he referred to the subscription of a fund of $125,000 to help the Independent cause. He has prepared a system of card indexes of the 18,000 Independent telephone companies, also of leading telephone articles that have appeared within the last few years. Statistical data are being prepared on rates and other details of service. In general it has been found that the cost of service has risen and rates are quite commonly too low. He showed this forcibly by comparing the Bell companies' rates in South Carolina and Georgia with those prevailing on the Independent systems in Illinois and Indiana. The latter are considerably below those in the South for exchanges of equal size.

The Thursday morning session of the convention opened with the reading of a paper on "How Can Discrimination and Cut Rates Be Prevented?" by Manford Savage, of Champaign, Ill. An

abstract of this paper follows:

Mr. Savage contended that the best plan would seemingly be to have complete laws enforced by fair public service commissions. He was not in favor of an exclusive telephone commission, but rather a general public utility commission absolutely free from political influence. Many laws are already on the statute books which require absolute equality of treatment to all consumers or patrons of a public service corporation. Mr. Savage thought that municipal commissions would give more prompt action than state or federal commissions. At any rate ruinous competition must be prohibited as well as unfair combinations to stifle competition. Commissions must be authorized to fix maximum rates as well as the minimum charges. The theory of governmental regulation is to prevent confiscation of the public and of the private rights. In conclusion the speaker expressed his belief that compulsory measured service would probably solve the rate problem.

J. B. Hoge, of Cleveland, Ohio, then presented a brief paper on "Telephone Fire and Income Insurance," in which he explained the formation of the Fire Insurance Exchange, which has made a careful study of insurance of telephone properties. He explained the methods of examination and frequent inspection which are maintained and their value in suggesting ways to diminish the fire hazard. He recommended that eighty per cent insurance should be carried on all insurable telephone property. The Exchange has been the means of saving a great deal on the insurance premiums of telephone companies. He also spoke of the income insurance and of the arrangement for supplying emergency switchboards on short notice.

This paper was discussed by B. G. Hubbell, of Buffalo, and Theo. Gary, of Macon, Mo. Both these speakers stated that the work of this insurance exchange had proved highly satisfactory and economical to its patrons. Moreover, it had served as a means of bringing Independent telephone companies together. President Woods also spoke briefly along these lines.

The convention adjourned at this point so that an executive session might be held in the afternoon.

The executive session was called for the purpose of discussing among the representatives of the members companies the negotiations that had been conducted between representatives of the banking house of J. P. Morgan & Company and a large number of leading Independent telephone men. A great many rumors had been current in the newspapers respecting the object of these negotiations, it being frequently contended that they were undertaken on behalf of the Bell interests through the Morgan house and with the object of merging all of the telephone systems of the country into a gigantic telephone trust. The object of these conferences had been to see if a common ground could not be found in order to eliminate many of the destructive features of the severe competition that has been carried on in many sections of the country by both the Bell and Independent interests. The plans had not proceeded far enough to permit of a final report on these conferences. The Independent representatives naturally were very cautious of the terms that had been offered and the entire negotiations are far from being complete.

The final session of the convention was called on Friday morning, with Vice-President E. B. Fisher, of Grand Rapids, Mich., in the chair. A very exhaustive paper on "The Effect of Compulsory Connection on the Future of Independent Telephone Companies" was read by Theo. Gary, of Macon, Mo.

Mr. Gary's paper, which was in several parts, and was accompanied by exhibits in the form of typical contracts, stated at the outset that physical connection began between the Independent and Bell companies by contract and later, about 1904, by the so-called sub-license agreements. The latter, he stated, were evidently one-sided and were therefore generally ignored by Independent companies. Later a form of contract was drawn up between the competing interests which was to the mutual advantage of both of them. It placed no limit on the kind of instruments to be used. Still later contracts were drawn up between various Independent companies to prohibit any alliance with the Bell interests and to provide exclusive Independent service. These latter contracts have been declared to be against the anti-trust laws by the courts of Missouri. Other courts, however, have sustained them. All forms of contract have become more liberal in later years. The state laws of Oklahoma, Montana, and South Dakota require the physical connection of telephone systems and in fact it is now in use by about 8,000 companies throughout the country, involving about 2,000,000 telephones. It is an outcome of the public demand for the extension of the service. The Independent Association, however, has steadily opposed the physical connection as it seemed to be the breaking down of the barrier between sworn enemies. He cited the case of his own home town where he was compelled to sell his telephone property in order to live up to the professional ethics of the Independent cause. He thinks it was a mistake for the Independents to take this one-sided view of physical connection. He cited the opinion of a prominent jurist in favor of universal physical connection in order to give the best and broadest possible service to the public. The public now demands regulation of public utilities by commissions rather than by competition. The speaker himself thought that an order from a properly constituted commission compelling physical connection would make all companies really independent of Bell and other interests. The ethics of the Association have had a depressing effect on the industry. There has been an excess of sentiment and a dearth of sound business sense. Similarily, some fifty years ago the railroads opposed the through billing of freight. Now business would be at a standstill without it. There is growing a strong public demand for universal telephone interconnection. The Independent men should supply this demand, because soon the laws and commissions will make it compulsory. Commissions will have to decide on the technical and traffic details, standardization of equipment to make interchange connections feasible, and rates. They must be empowered to order such connections by right of eminent domain and insist on fair and equitable compensation to all parties.

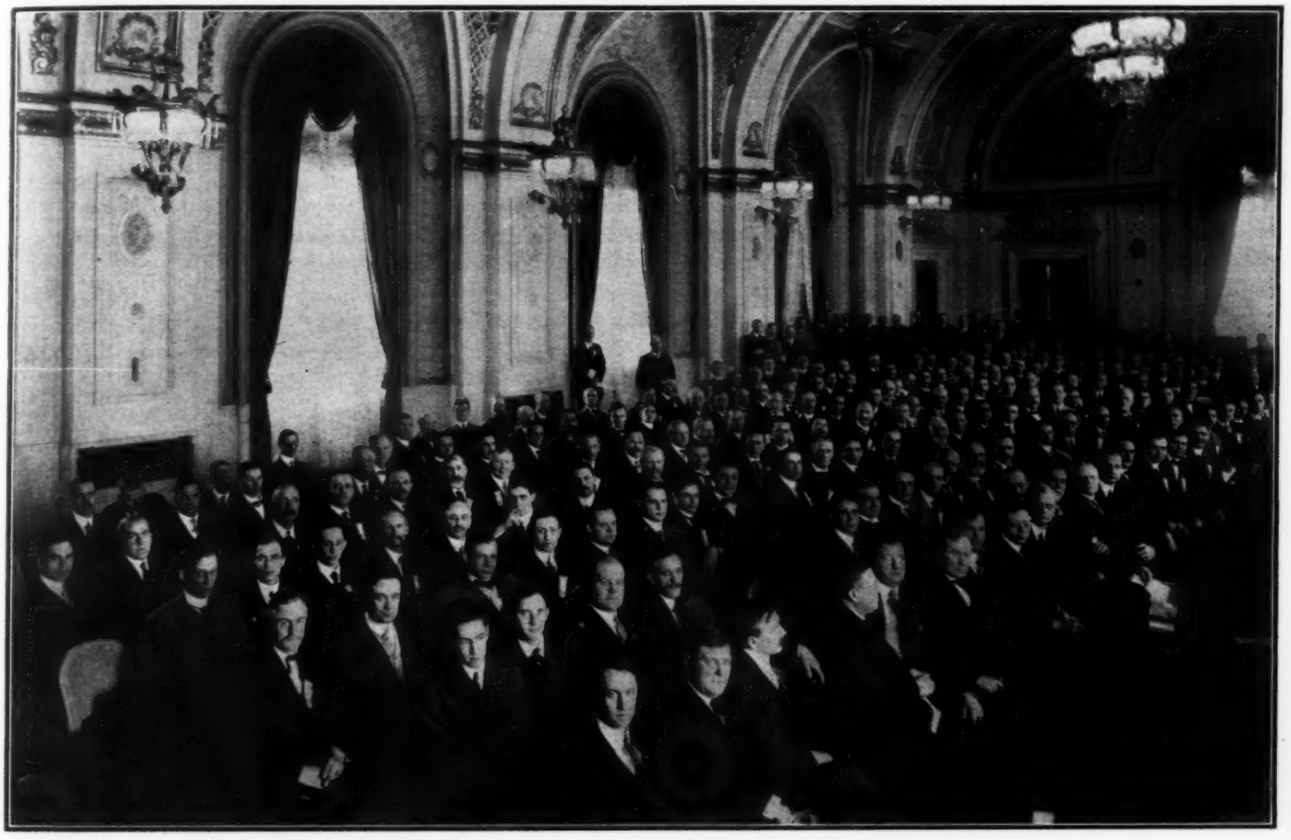
President Woods spoke of a conference held with the Interstate Commerce Commission respecting its new powers over interstate telephone traffic. The Commission is now considering the extent of its jurisdiction and will make its policy public before carrying it into effect. Meanwhile, companies are not under obligation to maintain an agent at Washington.

A. A. Godard, of Kansas, presented a tentative report of the legislative committee to draft a public utility law. This is being done by the committee, which has secured copies of nearly all such laws now in force or pending. This law will provide for the creation of a public service commission to regulate all utilities equitably.

N. G. Hunter then presented a series of resolutions on behalf of the committee on resolutions. These were all adopted unanimously. The first denied the statements in the press that the Association is dealing with the Bell or Morgan interests and strongly reaffirmed adherence to Independent principles. The second advised the state associations and members generally to advocate legislation looking to the equitable control of public utilities by properly constituted commissions, their establishment in states where they have not yet been formed and their strengthening where already formed; also that the ambiguities of the Interstate Commerce Act respecting the Federal control of telephone companies be rectified so as to make the Interstate Commerce Commission have as full powers in its field as the state commissions have in theirs. Other resolutions thanked the press, the hotel management, W. D. Kerr and others, who had contributed to the success of the convention.

The report of the nominating committee was accepted and a joint ballot cast for the election of the following-named gentlemen as directors of the Association for the ensuing year: E.

B. Fisher, Michigan; H. D. Critchfield, Illinois; R. Valentine, Wisconsin; E. H. Moulton, Minnesota; Theo. Gary, Missouri; W. J. Uhl, Indiana; A. E. Boqua, Arkansas; F. H. Woods, Nebraska; F. M. Kondolf, New York; S. E. Ward, Ohio; L. D. Kellogg, Illinois; Manford Savage, Illinois; B. G. Hubbell, New York; J. C. Casler, Texas; E. D. Schade, Pennsylvania; N. G. Hunter, Indiana, and W. G. Melchers, Michigan. These directors will meet on February 18 to elect the officers of the Association.



NATIONAL INDEPENDENT TELEPHONE ASSOCIATION IN CONVENTION SESSION.

TECHNICAL CONFERENCES.

The three technical and operating conferences were held as separate sessions from the main convention gatherings. These conferences were presided over by L. E. Hurtz, of Lincoln, Neb. The first one was on Wednesday afternoon.

William Dunton Kerr, of Chicago, presented the first conference paper, his subject being "Public Relations of Telephone Companies."

Mr. Kerr's paper covered thirty closely printed pages and was divided into five parts, each a carefully prepared review of the subject. I—State Utility Commissions—Mr. Kerr traced the development of government control of public utilities and showed how it has found its best expression in the numerous and almost always fair-minded state commissions. The aim of the public and the utilities is the same, although frequently beclouded by misunderstandings; the impartial attitude and co-operative spirit of the commissions has made them of immense service to both the public and companies. The commissions must be constituted of the highest personnel, must have ample powers and broad jurisdiction, and must be provided with adequate funds to carry on requisite investigations. II—Service—In analyzing telephone service, Mr. Kerr pointed out its distinctive public-utility character and responsibilty. As affecting the quality of the service, a wide margin of facilities must be provided to serve all applicants. high-grade equipment only is required and intelligent and prompt work must be done by all operatives. The cost of the service is affected by the heavy readiness-to-serve expenses which must be provided before any service, light or heavy, can be given; the quality of service demanded also determines its cost. III—Rates.—Two ways of measuring the benefits of telephone service present themselves, one by its value to the users, the other by its cost to the producer; the former is inequitable and results in a haphazard system of charges; the latter is the only fair way to determine a schedule of rates, because of the quasi-public nature of the service. In establishing rates careful consideration must be given to the fixed as well as the variable costs of providing the service. IV—Efficiency and Economy.—In taking up this feature, Mr. Kerr dwelt on the various departmental activities of a telephone company and showed the importance of a complete accounting system to enable a proper analysis of income and expenses. V—Meeting Public Requirements.—Co-operation with the public is the keynote of success in public utility service. Additional features are high-standards of service, careful analysis of costs in determining rate schedules, observance of close economy in all departments, uniform accounting system and full publicity of reports.

In discussing this paper G. R. Johnston, of Ohio, spoke of the proposed telephone commission bill now being considered by the Ohio Legislature. It is very comprehensive in the powers it confers on the commission, these including, among others, the power to regulate rates, to require good service, to insist on depreciation funds, to prevent competition in districts already well provided telephonically, to permit and regulate physical connection of telephone lines, etc. As to rates, he contended that a strict cost basis is difficult to use in all cases. Many factors enter that have no immediate relation to cost.

Hugh T. Wreaks, of the Wire Inspection Bureau, New York, then read a paper on "Inspection of Telephone Wire."

Mr. Wreak's paper shows forcibly the value of factory inspection of wire as an important feature in making satisfactory purchases. Specifications are of no value unless materials are inspected to see that they conform to the requirements. These tests should be made at the place of manufacture before shipment. He then gave a summary of the principal practical tests

of braid and rubber insulation, copper wire, tinning, copper-steel wire, galvanized-iron wire and lead-covered cables.

In the discussion of Mr. Wreaks' paper, B. F. Wasson inquired as to the best kinds of iron wire for pole lines and for drop wires from the poles to the houses. He had had much trouble with BB galvanized wire giving way after three or four years of service. Mr. Wreaks replied that a heavier galvanizing coat should be required. The manufacturers would be glad to provide it, but under the old bending tests of galvanized wire only a thin coat was permissible without cracking. As sharp bending is not used in practice, the old tests should be discarded.

At the Thursday morning conference B. F. Wasson, of Clinton, Ill., read a paper based on his booklet of "Construction Signal Rules." This gave an excellent and simple code of signals by arm movements or whistles by means of which linemen could save much time and labor and prevent misunderstandings and mistakes.

Taking up some questions from the Question Box, considerable attention was devoted to the subject of phantom circuits. Geo. K. Gann, of Lincoln, Neb., stated that nearly one-third of the circuits of his company were phantoms. These are found to be the best and least troublesome of all the circuits. The coils in the physical circuits cause no appreciable decrease of the talking efficiency. Mr. Hurtz emphasized the value of phantom circuits and stated that a company that does not use them to the utmost is not getting all it can from its physical plant.

There was also some discussion of the maintenance cost per telephone and but few present could state what this was, as the total costs are usually lumped together. About $8.50 per telephone was given as the combined maintenance and operating cost in systems of from 1,000 to 2,600 stations.

At the conference on Friday morning A. J. Shands, of St. Louis, Mo., presented a paper on "Private-Branch-Exchange Traffic."

Mr. Shands' paper goes into some detail respecting the growth of private branch exchanges and the best methods of controlling their traffic. Much trouble has been found from inexperienced or careless private operators. The suggestion is made to have the operators on the payroll of the telephone company, or, if this were impracticable, to have the company's supervisors make occasional calls on the operators to instruct them how to improve the service.

Geo. K. Gann, of Lincoln, Neb., read a paper on "The Handling of Special and Emergency Long-Distance Traffic."

Mr. Gann's paper took up various classes of special service, some of which should be refused and others provided. The question of policy should be taken into account as well as that of profit in determining the handling of such special service. Some classes, such as election returns, baseball returns, etc., are always profitably handled. Emergency service due to storms or sleet, is often taken care of satisfactorily by decreasing the number of circuits per operator, by composite telegraph and telephone working, and by makeshift phantoms. He again dwelt on the high value of phantoms and cited eight cases of trouble on phyhical circuits in only two of which the phantom also was out of commission; in three cases both physical circuits were out of service and the phantom was still working.

Owing to lack of time or absence of the authors several papers were read by title only. Among these were "Telephone By-products" by H. H. Robinson, of Detroit, Mich.; "Securing of 30,000 Telephone Subscribers" by F. S. Williams, of Chicago; "Specifications for Lead-Covered, Dry-core Cable" by L. C. Griffiths, of Louisville, Ky.; "Modern Statistical Methods" by Chas. E. Spencer, of Chicago; "Traffic Economies" by W. S. Vivian, of Grand Rapids, Mich.

BANQUET.

On Thursday evening the annual Association banquet was held in the large banquet ball of the hotel. This was well attended. Manford Savage acted as toastmaster. Among the speakers of the evening were B. G. Hubbell, N. G. Hunter, W. Vischer, H. D. Critchfield.

EXHIBITS.

The exhibits at the 1911 convention were of a comprehensive character, representing all branches of telephonic equipment. They attracted a great deal of attention from the telephone men of all parts of the country and afforded the latter an opportunity for placing many orders for the most modern apparatus.

Space does not permit a detailed description of the individual exhibits. Among the exhibitors were the following:

American Electric Telephone Company, Chicago.—Magneto switchboards, telephones and dry batteries.

American Electrical Works, Providence, R. I.—Cables, iron and copper wire.

American Steel & Wire Company, Chicago.—Wire of all kinds.

Anderson Electric & Manufacturing Company.—Lock-out apparatus.

Automatic Electric Company, Chicago.—Automatic telephones and systems.

Automatic Enunciator Company, Chicago.—Loud-speaking transmitters.

Baird Manufacturing Company, Chicago.—Pay stations, time stamps.

Baugh Cable Clip Company, Hopkinsville, Ky.—Cable clips.

Belden Manufacturing Company, Chicago.—Inside and weatherproof wire, tape, etc.

Bloss, Newell W., Boston.—Randall automatic repeaters and transmitters.

Brown (Will), Advertising Company, Minneapolis.—Directory and advertising art shop.

Cook, Frank B., Chicago.—Protective apparatus and cable terminals.

Corwin Telephone Manufacturing Company, Chicago.—Interior telephones.

Cracraft Leich & Company, Genoa, Ill.—Telephones, switchboards and apparatus.

Dean Electric Company, Elyria, Ohio.—Telephone switchboards, harmonic ringers, etc.

Duplex Metal Company, Chicago.—Duplex telephone wire.

Electric Appliance Company, Chicago.—General telephone supplies.

Electric Appraisal & Inspection Company, Cleveland, Ohio.—Pyrene fire extinguisher.

Electric Specialty Manufacturing Company, Cedar Rapids, Ia.—Wireless cable testers.

Electric Storage Battery Company, Philadelphia.—Storage batteries.

Ericsson Manufacturing Company, Buffalo, N. Y.—Telephones, switchboards, and specialties.

Harvard Electric Company, Chicago.—Electrical specialties.

Holtzer-Cabot Electric Company, Chicago and Brookline, Mass.—Telephone parts and supplies.

Indiana Steel & Wire Company, Muncie Ind.—Wire and stranded conductors.

International Gradolph Electric Company, St. Louis.—Long-distance transmission appliances.

Kellogg Switchboard & Supply Company, Chicago.—Switchboards, telephones and parts.

Matthews, W. H. & Brother, St. Louis.—Guy anchors, line materials.

Miller Anchor Company, Norwalk, O.—"Safety" anchors.

Monarch Telephone Manufacturing Company, Chicago.—Switchboards, telephones, time-service systems and supplies.

National Carbon Company, Cleveland, O.—Dry batteries.

Naugle Pole & Tie Company, Chicago.—Telephone poles.

Nilson-Dillenbeck Company, Chicago.—Electric soldering irons.

North Electric Company, Cleveland.—Auto-manual and manual switchboards, telephones and telechonometers.

Nungesser Electric Battery Company, Cleveland.—Dry batteries.

Paragon Sellers Company, Chicago.—Batteries, wire, grounding devices, supplies.

Signalphone Alarm Company, Milwaukee.—Fire alarm and signal boxes.

Specialty Device Company, Pittsburg.—Bierce cable sleeves.

Standard Underground Cable Company, Pittsburg.—Cables and wire.

Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., Chicago, Ill., and Kansas City, Mo.—Telephone apparatus, aerial and underground cable.

Swedish-American Telephone Company, Chicago.—Telephones, switchboards and parts.

C. M. Taylor Company, Inc., Paris, Ky.—Taylor tree trimmer.

Thompson-Leavering Company, Philadelphia.—Electrical measuring instruments.

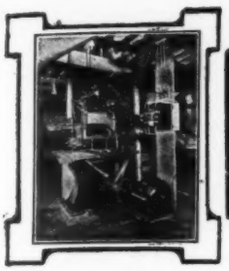
Telephone Fire Insurance Exchange, Cleveland.

Telephony and American Telephone Journal, Chicago.

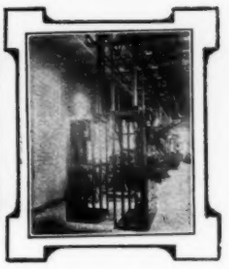
Valentine-Clark Company, Chicago.—Poles and preservation.

Vote-Berger Company, La Crosse, Wis.—Telephones and apparatus.

Warner Electric Company, Muncie, Ind.—Pole-changers.



Industrial Power



WINTER USES FOR ELECTRIC FANS.

BY ALBERT SCHEIBLE.

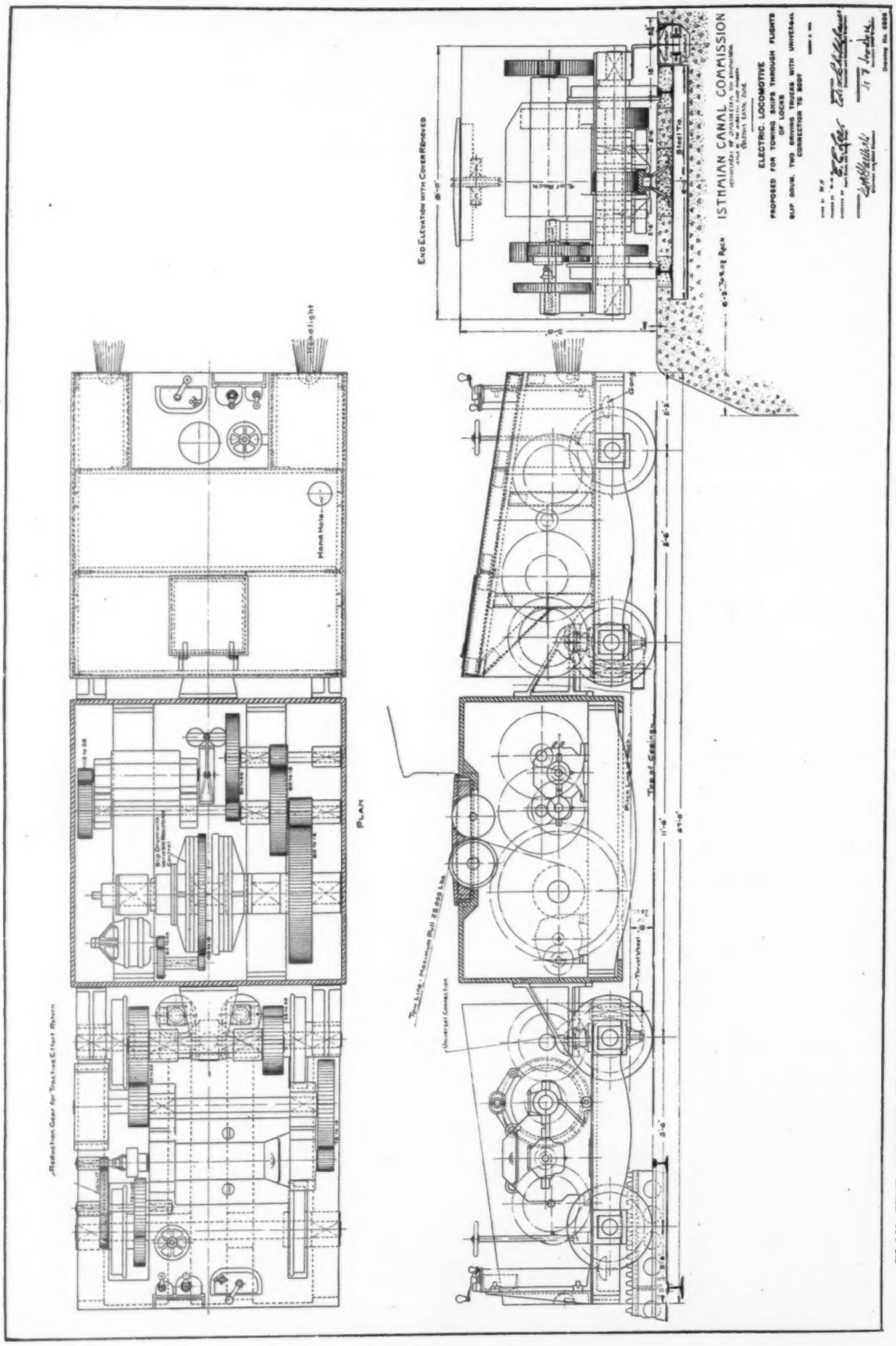
Most users of electric fans store them as soon as the cooler weather sets in, evidently assuming the fans to be useful only for making them comfortable during warm days and nights. And yet a study of indoor air conditions will show that the electric fan really can serve a greater variety of useful purposes in the average room during the winter than during the summer, for the prime function of any fan is air-moving and the cooling effect which we enjoy in summer is only one of many results obtainable from the air movements. Indeed, the refreshing effect produced by the use of fans during warm weather is due only in part to the cooling of the skin, the rest of the action being explained by the diffusing of the air so as to distribute the carbon dioxide and other products of exhalation. This dissemination of the products of breathing can be accomplished about as effectively in winter as in summer by a forced circulation, and, even in somewhat underheated rooms, it will have a refreshing effect on the occupants if there are too many of these to expose each to such air currents as may ensue from the arrangement of the heating and ventilating devices in the room or hall.

Of course, there is danger of exposing the occupants to unhealthful drafts if strong air currents are blown against them in rooms that are not overheated (*i. e.*, not over 68 or 70 degrees Fahrenheit), but most electric fans are easily adjusted as to the initial direction of the air moved by the same and with the exception of modern theaters in which air passages are provided under each row of seats, most halls and assembly rooms when well filled need a forced circulation to prevent the stagnation of air which leads to drowsiness. This circulation will not always be safely obtainable by using electric fans on the same wall brackets from which they have been doing effective service during the summer, for the walls transmit so much of the outside cold during the winter that the fans if used in their old locations are likely to create uncomfortably chilling air currents. In some cases this can be remedied by moving the fans to places on the walls just above the radiators, while in other instances they will need to be moved to pillars or other points distant from the chilled walls.

In the average home or store this problem of air stagnation and of the consequent "stuffiness" indicating an improper diffusion of exhalation products through the air, is too rare to require the use of a fan. Here the electric fan is needed in winter not for air purifying but for creating such air currents as will distribute either heat or moisture. Thus in the average steam-heated room, the ordinary convection currents of air are too slow to create an even temperature, so that it is quite common to have the immediate vicinity of a radiator overheated while the opposite side of the room is far below the normal. In such cases it is easy to use an electric fan to intermingle the air strata and thereby distribute the heat more evenly. This is usually done by setting the fan on the floor and letting it blow the air towards the radiator, a simple expedient which should be more generally used in sick rooms where patients so often are uncomfortably cold although within five or ten feet of hot radiators.

The same holds true of furnace-heated rooms where the air currents usually carry the heat unevenly to different parts of the room. Here the fan may be set right in front of the floor or wall register and many a woman will be surprised at the comfort afforded her by using a fan in this way for a short time early in the morning. Incidentally, this also makes an effective method of forcing the air through a riser which is not getting its proper share of the hot air from the furnace, either because the furnace connection to it is too nearly horizontal or because the wind happens to be in the wrong direction. When a register on such a hot-air shaft refuses to do its duty, a fan placed in front of it will start the air up the shaft and usually the fan need only be run until the air pipes are well warmed, after which the hot-air currents will continue without artificial aid. Of course such a temporary use of an electric fan in one room or another will not be needed where a fan is permanently inserted in the air shaft of the furnace.

In stores the uneven distribution of heat is not so apt to be bothersome as in residences, but the coating of window panes with a film of frost or of moisture interferes seriously with the business-drawing powers of the store windows. As this coating forms only because the glass is so much colder than the air in the store, the remedy consists in simply blowing a current of hot air against the panes long enough to warm and dry them. While this same frosting or dimming of the window panes in a home is not objectionable from a commercial standpoint, it is serious in other ways, as the moisture thus deposited must be taken from the air of the room which is thereby robbed of a part of its humidity. In summer the open windows permit a much greater exchange of air with the outside, allowing the moisture content of the rooms to average more nearly normal in climates like those of Chicago or New York, but this is not feasible in winter and in most homes the air during the cooler months is so far below the normal in its humidity as to tend towards pneumonia and allied affections. This already dry air is made still less healthful when it is allowed



PLAN, SIDE AND END ELEVATION OF ELECTRIC LOCOMOTIVE PROPOSED FOR TOWING SHIPS THROUGH FLIGHTS OF LOCKS, PANAMA CANAL.

to deposit part of its moisture on the window panes, hence any method of redistributing the moisture through the air of the room will improve its healthfulness. Here, as in the stores, the deposit on the windows is soon removed by letting the fan blow against the lower panes, for which purpose the fan may need to be placed on a chair or table.

Then if such a brief use of an electric fan will restore the humidity of the air to its former meager proportion, why not use the fan for diffusing added water vapors so as to bring the moisture content of the air up to a healthful normal? Most users of steam or hot-water radiators know that the use of water pans in the arid rooms is disgustingly ineffective, largely for the reason that the air moves over the surface of the water at a very slow rate. Any forced circulation of this air, allowing more of it to absorb moisture, will increase the humidity of the air in the room. Even where air moisteners are attached to the radiators, a forced current of air through the same may be advisable whenever the humidity in the room falls too low. At present, even our hospitals are paying too little attention to this important question of humidity, being partly excused by their not finding simple and dependable means for judging the same. But the gradual rousing of physicians to the necessity of proper air moistening, should count before another winter is over and should induce a much more extensive use of electric fans during the cooler months.

It will be noted that most of these winter uses of electric fans imply their being placed either on the floor or close to the same, while for their summer functions they are generally located high on the walls. To facilitate such a low placing of the fans and to avoid the necessity of long cords, it may be advisable to provide special outlets (preferably flush wall receptacles) near some of the radiators or registers. For, with such varied and important winter uses for the portable electric fan, why should we not plan our house wiring to accommodate the same, thus allowing us to profit all the year round by the service of the low-priced but efficient device which too long has been unfairly restricted in both the time and the range of its helpfulness?

Electric Locomotives for Panama Canal.

Bids recently invited on material for a rack railway to be constructed along the lock walls of the Panama Canal will be followed shortly by a call for proposals on the construction of a number of electric locomotives of unique design which will be used for towing vessels through the locks. The machine as designed consists of three parts. Two of these, the front and rear sections, will be mounted upon rigid four-wheel trucks, each one of which is driven by an independent motor controlled from either end of the machinery. The middle section is connected to the two tractive elements by universal joints, and is equipped with a slip-drum towing windlass and hawser, so that the line may be veered and hauled at pleasure without any motion of the locomotive along the track. In towing, the locomotive derives its tractive effect from one of the end elements through a pinion engaging a shrouded, semi-suppressed rack anchored in the coping. The side-pull of the hawser is taken up by horizontal thrust wheels which bear on the side of the track. The current for the operation of the locomotives will be taken from underground circuits. The maximum pull on the tow-line is fixed at 25,000 pounds, at which force a friction coupling will relieve further strain. The central racks are to be provided only on the towing tracks and inclines. On the level portion of the return tracks the locomotives will run by friction on the side rails after the fashion of the ordinary electric railway.

In towing a vessel through the locks a number of these locomotives will be employed, varying as the size of the vessel. The typical case will require four machines, two ahead, one on each wall, imparting motion to the ship, and two astern, one on each wall to aid in keeping the vessel in a central position and to bring it to rest at the proper point inside the lock chambers. In passing vessels up through the locks, the forward locomotives will climb up the inclines of the walls to the level of the next lock chamber while the water levels are being equalized, and will not be required to exert towing effort while doing so.

In the accompanying illustration is shown a plan view, and side and end elevation of this locomotive. The speed when towing will be two miles per hour and five miles per hour when returning. The speed of the slip drum when towing will be ten feet per minute and 200 feet per minute when idle. The motor equipment comprises two seventy-five-horsepower motors running at 500 revolutions per minute, for driving units; one seven-and-one-half-horsepower motor operating at 750 revolutions per minute for the slip drum at ten feet per per minute; and one two-horsepower motor, operating at 750 revolutions per minute, for the slip drum at 200 feet per minute. The starting torque for each of the seventy-five-horsepower motors at one foot radius is 1,150 pounds.

Electrically Driven Plate-Shearing Machine.

An electrically driven plate-shearing machine has been installed in Zeltwig, Styria, which will cut cold-steel plates two centimeters thick, making six cuts per minute on sheets 180 centimeters wide.

A special feature of this shearing machine is that the slide carrying the shearing tool is operated from oscillating levers mounted outside the vertical standards, this doing away with the usual crank-shaft, the crank-pins operating the levers being fixed on the outer ends of the operating shaft. The slide holding the shearing tool and the levers are steel castings; the latter balance the cutting-tool holder in such a way that it can remain in its highest position; a safety brake is also provided for the machine.

Two holding-down devices, operated by eccentrics and levers cast in steel, serve to secure the plate upon the table while cutting is proceeding. The machine is direct-coupled to a fifty-horsepower electric motor; it weighs 33,000 kilograms (over 36 tons).—*Engineering.*

Electric Forges.

In adapting electric power to forges the driving motor is directly connected to an all-steel fan that runs at 1,700 revolutions per minute. The motor and fan case are mounted on a bracket fastened to one of the rear legs. The only wiring necessary is a plug connection to a lamp socket, if the forge be portable.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

HUDSON & MANHATTAN RAILROAD.

The New York Public Service Commission has issued a report of the Hudson & Manhattan Railroad Company for the quarter ended September 30, 1910, compared as follows.

	1910	1909
Total operating revenue....$	567,137	$ 374,400
Net operating revenue.....	328,349	178,313
*Deficit	48,649	79,785

*After deducting charges and taxes and credit other income. Only interest on capital employed in operation is deducted.

THIRD AVENUE RAILROAD.

The New York Public Service Commission has issued a report of the receiver of the Third Avenue Railroad Company for the quarter ended September 30, 1910, compared as follows:

	1910	1909
Total operating revenue.....$	918,082	$ 821,132
Net operating revenue.....	488,981	406,082
*Surplus after deducting charges and taxes and credit other income.....	318,419	280,885

*Interest permanently defaulted is not deducted.

UNITED TRACTION COMPANY

The report of the United Traction Company, (Albany-Troy) for the quarter ended September 30, 1910, compares as follows:

	1910.	1909.
Total operating revenue.....	$572,715	$554,361
Total operating expenses.....	344,246	312,804
Net operating revenue.....	228,469	241,557
Taxes accrued	33,000	33,000
Operating income	195,469	208,557
Non-operating income	50,121	50,035
Gross income	245,590	258,592
Total deductions from gross income	98,986	94,733
Net corporate income.....	146,604	163,859

AMERICAN DISTRICT TELEGRAPH.

The American District Telegraph Company, of New York has issued its report for the year ended December 31, 1910. The income account compares as follows:

	1910.	1909.
Revenue from all sources.....	$580,008	$549,225
Expenses, all class.....	491,503	464,661
Net	†88,504	84,563
Dividends	76,888	76,888
Surplus	11,616	7,675
Miles of wire.....	1,664	1,612
Offices	79	80
Instruments	36,466	35,875

†Equal to 2.3 per cent earned on $3,844,700 capital stock compared with 2.2 per cent earned last year.

TORONTO RAILWAY COMPANY.

The Toronto Railway Company has issued its report for the year ended December 13, 1910. The income account compares as follows:

	1910.	1909.
Gross	$4,377,110	$3,926,828
Operating expenses	2,237,182	1,995,914
Net	2,139,928	1,930,914
Charges	†928,768	838,532
Surplus	*1,211,160	1,092,382
Dividends	560,000	560,000
Surplus	651,160	532,382
Conting account	.....	150,000
P. & L. surplus.....	651,160	382,382

†includes payment of city's percentage, $727,480 in 1910, also paving charges, taxes, etc.

*Equal to 15.15 per cent earned on $8,000,000 capital stock, comparing with 13.65 per cent earned on same stock last year.

PHILADELPHIA ELECTRIC.

The Philadelphia Company and affiliated corporations report for the nine months ending December 31, 1910, as follows:

Gross earnings	$14,679,391
Expenses and taxes	8,349,310
Net earnings	6,330,081
Other income	178,703
Total income	6,508,784
Fixed charges and preferred dividends	3,671,611
Net income	2,837,173
Improvements, betterments, extensions, etc.	570,568
Surplus	2,266,605
Proportion due to other owners of common stock of affiliated corporations..	2,397
Available for Philadelphia Co.....	2,264,208

Items representing transactions between companies have been eliminated in this report.

TWIN CITY RAPID TRANSIT COMPANY.

The Twin City Rapid Transit Company has issued its pamphlet report for the year ended December 30, 1910. The income account compares as follows:

	1910	1909
Gross	$7,531,649	$6,969,776
Expenses	3,667,702	3,294,627
Net	3,863,946	3,675,149
Interest and taxes.....	1,466,394	1,466,527
Surplus	*2,397,552	2,208,622
Dividends	1,416,000	1,265,250
Surplus	981,552	943,372
App. for ren.....	736,000	703,000
Surplus	245,552	240,372

*After allowing for 7 per cent dividends on the $3,000,000 preferred stock the balance $2,187,552, before deducting depreciation is equal to 10.88 per cent on the $20,100,000 common as compared with 9.94 per cent earned on same stock previous year.

LAKE SHORE ELECTRIC RAILWAY.

The Lake Shore Electric Railway System reports for the month of December and twelve months ended December 31, compared as follows:

	1910	1909
Gross earnings .....$	95,570	$ 89,062
Expenses and taxes.....	52,640	47,754
December net	42,930	41,307
Interest	34,702	35,011
December surplus	8,227	6,296
Twelve months' gross.....	1,206,111	1,109,083
Expenses and taxes.....	632,532	586,184
Twelve months' net.....	573,578	522,899
Interest	417,049	414,950
Twelve months' surplus..	156,528	107,949

METROPOLITAN STREET RAILWAY.

The New York Public Service Commission has issued a report of the receivers of the Metropolitan Street Railway Company, for the quarter ended September 30, 1910, compared as follows:

	1910	1909
Total operating revenue....$	3,444,582	$3,370,955
Net operating revenue.....	1,421,611	1,282,597
*Surplus after deducting charges and taxes and credit other income.....	508,355	339,979

*Interest permanently defaulted is not deducted.

BROOKLYN RAPID TRANSIT.

The New York Public Service Commission has issued a report for the lines comprising the Brooklyn Rapid Transit System, for the quarter ended September 30, 1910, compared as follows:

	1910	1909
Total operating revenue....$	6,016,801	$5,773,439
Net operating revenue.....	2,753,472	2,534,519
Surplus after deducting charges and taxes and credit other income.....	936,850	766,647

In the above statement inter-company transactions involving duplications have not been eliminated.

NASHVILLE RAILWAY & LIGHT.

The Nashville Railway & Light Company reports for the year ended December 31, 1910, compared as follows:

	1910.	1909.
Gross	$1,832,465	$1,724,380
Expenses and taxes	1,030,016	1,013,883
Net	802,438	710,497
Interest	402,426	394,353
Balance	400,012	316,144
Depreciation	54,860	51,513
Surplus	354,151	264,631
Miscellaneous revenues, transportation, profit and loss	.....	.....
Surplus	345,151	264,631
Preferred dividends	125,000	125,000
Surplus	*220,151	139,631

*Equal to 5.5 per cent on $4,000,000 common stock.

PUBLIC SERVICE CORPORATION.

The Public Service Corporation of New Jersey has made a report to the New York Stock Exchange of the combined income account of all companies, including Public Service Corporation, for the year ended December 31, 1910, which compares as follows:

	1910.	1909.
*Gross revenue	$29,205,194	$26,560,451
Expenses and taxes.....	14,611,297	13,331,228
Net	14,593,896	13,229,222
Charges, etc.	12,393,599	11,800,775
Surplus	2,200,297	1,428,447

*including miscellaneous income.

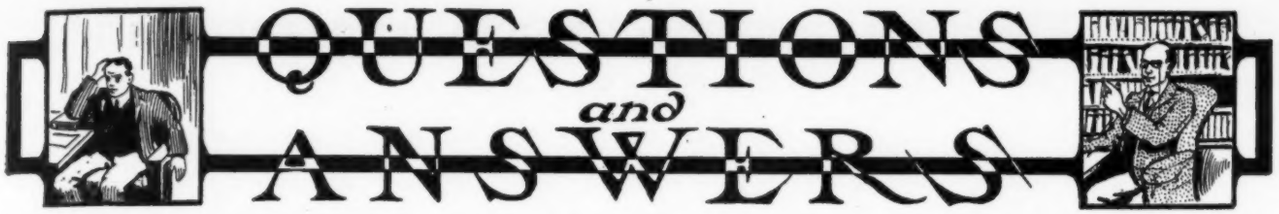
SHAWINIGAN WATER AND POWER COMPANY.

The Shawinigan Water & Power Company reports for the year ended December 31, 1910, a surplus after deducting charges of $407,225, equal to 4.8 per cent on the $8,500,000 stock. This compares with $321,307 the previous year, equal to 4.6 per cent on $7,000,000 stock then outstanding. It is expected that the Company will be greatly benefited by a contract for 40,000 horsepower recently made with the Montreal Light, Heat & Power Company.

Cleveland Railway Company.

A statement of the net results of operations of the Cleveland Railway Company, under the Taylor ordinance, was recently given to the Cleveland City Council. The report is as follows:

Month. 1910.	Surplus.	Deficit.
March	$18,880.94	
April	25,257.93	
May	26,355.29	
June		8,221.26
July		7,769.76
August		7,036.73
September		8,466.70
October	11,111.30	
November	9,306.89	
December	20,257.96	
	$111,170.31	$31,494.45
Deficit	31,494.45	
Net surplus .....$	79,675.86	
Surplus in operating fund first six months.....	22,294.06	
Total surplus .....$	101,969.92	
Interest charges improperly deducted	9,740.00	
Grand total surplus ....$	111,709.92	



RATING OF ALTERNATING-CURRENT GENERATORS.—How is the horsepower of the alternating generator rated?—R. E. G., Dolgeville, N. Y.

Alternating-current generators, like all electric generators, are usually rated in electrical units and not in mechanical units such as the horsepower. The rating is generally that output, expressed in kilowatts or kilovolt- amperes, which the machine can generate continuously without exceeding the following temperature rise above the temperature of the room (which is assumed to be 25 degrees centigrade or 77 degrees Fahrenheit): Field and armature, 50 degrees centigrade; brushes, 55 degrees; collector rings, 65 degrees; bearings and other parts of machines, 40 degrees centigrade. In alternating-current machines, the product of the normal rated current in amperes and the pressure in kilovolts does not give the true power output in kilowatts, unless the power factor is known to be unity or 100 per cent. Therefore, it is customary to state the power factor in giving the rating; for example, 1,000 kilowatts at 85 per cent power factor. If the power factor is not known the rating should be given in kilovolt-amperes.

COLOR ANALYSIS OF LIGHT.—Will you tell me why in different tables of absorption and reflection of light the white is decomposed into red, green and blue, instead of red, yellow and blue?—W. V., Montreal, Can.

Seven principal colors are easily recognized in the spectrum: red, orange, yellow, green, blue, indigo and violet. Green is nearest to the center of the spectrum and is recognized by scientists as one of the three primary colors: red, green and violet (or blue). These three colors of light cannot be resolved into any others, while yellow can be resolved into red and green or produced by mixing red and green light. In mixing pigments, however, it is found that a yellow and blue pigment mixed produces green; therefore for mixing pigments the three primary colors are red, yellow and blue. A further reason for the selection of green rather than yellow for the scientific primary colors is that color-blindness and other visual phenomena are best explained by the presence in the eye of three sets of nerves, those stimulated by red light, by green light and by violet light.

FREQUENCIES AND WAVE LENGTHS OF HEAT, LIGHT, ELECTRICITY, ETC.—What are the approximate frequencies, wave length and radiant order of light, heat, sound. electricity and magnetism?—C. O. S., Los Angeles, Cal.

Vibration frequencies between 34 and about 40,000 per second in air constitute audible sound, the corresponding wave lengths varying between about 29.4 and 0.027 feet, respectively. Electromagnetic vibrations in the ether cover a range of from about 400,000 to 2,000,000 or 3,000,000 per second with corresponding wave length of about one-half mile to some 350 feet. Heat is radiated in ether waves having a frequency in the neighborhood of 12,500,000,000 vibrations per second and a wave length of about 944 millionths of an inch. Light covers a frequency range of 344,000,000,000 to about 650,000,000,000 vibrations per second and wave length of 32 to 17 millionths inch.

TORQUE-WEIGHT RATIO OF METERS.—What is meant by the torque-weight ratio of a meter?—H. P. E., Harmon, Ill.

Some manufacturers of watthour meters having very light moving elements emphasize this fact by speaking of the high torque-weight ratios of their instruments. Where this term is used it means the ratio of the driving torque of the meter, expressed in suitable units, such as pound-inches, to the weight of the moving element resting on the main jewel bearing, the latter expressed in pounds. It is evident that the smaller the weight on this bearing the smaller will be the friction there; also the greater the driving torque the less relatively will be the friction torque. Therefore a high torque-weight ratio is doubly desirable.

RELIABILITY OF PHANTOM CIRCUITS.—I have heard it stated that phantom telephone circuits are more reliable than the ordinary circuits, but it seems to me that there would be more trouble on phantoms. Are there any cases on record to verify this?—M. A. L., La Porte, Ind.

It has been generally found by telephone companies that have used phantoms extensively that these circuits are less subject to serious troubles that put the line out of commission for commercial use than the physical circuits of which the phantoms are composed. A good illustration of this was given by George K. Gann, of the Lincoln (Neb.) Telephone & Telegraph Company, at the recent convention of Independent telephone men in Chicago (see page 348 in this issue). Among the chief reasons for this are that one or both physical circuits may be short-circuited without affecting the phantom, or one or both may be open on one side without appreciable effect on the phantom.

SYNCHRONOUS MOTOR STARTING.—We have a fifty-horsepower synchronous motor that has worked satisfactorily until last week, when we were unable to start it up in the morning. The field circuits and armature tested out all right and there seemed no mechanical trouble because we could turn the machine by hand and, in fact, started it by connecting to a line shaft from another motor, then throwing off the belt and closing the switch, when it ran all right. We again tried to start it directly and failed. What might be the trouble?—W. R., St. Louis, Mo.

If the electrical circuits were positively found free from "shorts" the trouble was probably due to the wear in the main bearings. As this wear goes on the revolving part of the machine gradually settles, causing a diminution of air gap at the bottom and increase at the top and resulting in magnetic unbalance. The effect of this is that the attraction between the field and armature is so strong at the bottom that it requires a very powerful torque to overcome it. The air gap should therefore be carefully measured at top and bottom and, if this is found to be unequal, the bearings must be rebabbitted.

New Electrical and Mechanical Apparatus and Appliances.

An Internal-Combustion Engine.

The type "F. H." oil engine which is now being manufactured by the De La Vergne Machine Company, New York City, has been designed with the idea of obtaining a thermal efficiency higher than any heretofore obtained and incidentally permitting more complete combustion of heavy fuel oils than has been customary in the past. It is claimed that with this engine, power can be produced at a cost of one-half cent per kilowatt-hour.

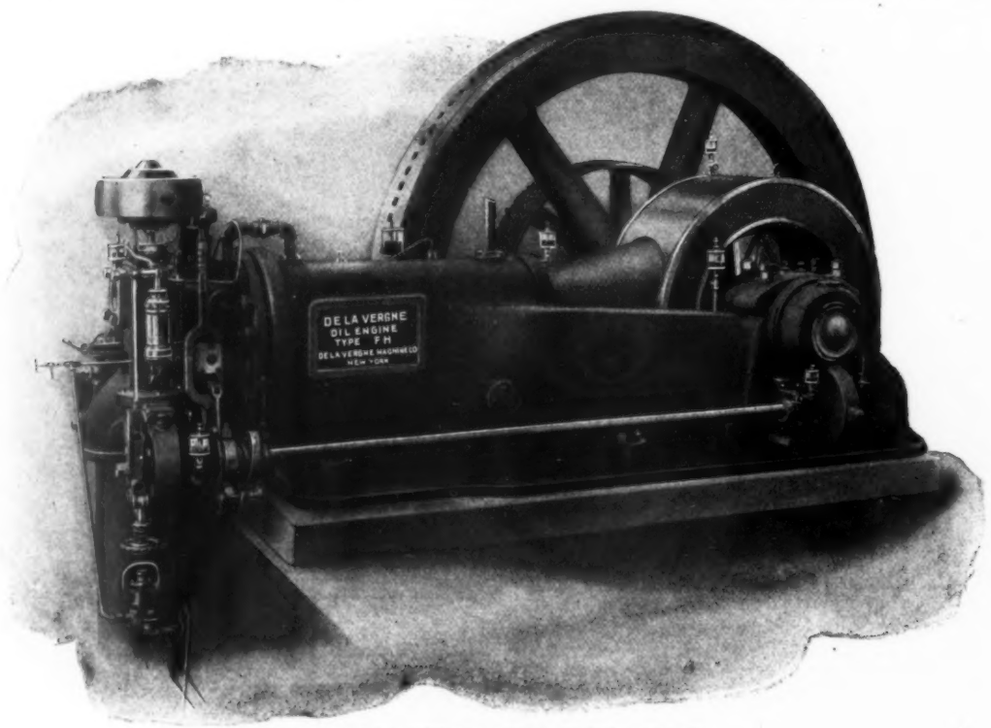


FIG. 1.—DE LA VERGNE TYPE FH OIL ENGINE.

The engine operates on a four-stroke cycle. The first outward stroke draws a charge of air into the cylinder through the inlet valve A shown in Fig. 2. This is held open by a suitable cam. At the beginning of the return stroke the air valve is closed and the air is forced into a small combustion chamber where it is compressed to about 300 pounds per square inch. The compression heats it to a high temperature which is increased by contact with the vaporizer.

At the completion of the compression stroke a highly atomized charge of fuel is injected under pressure into the same chamber, forming an explosive mixture which is at once ignited.

The fuel is raised by a small rotary pump from the storage tank to a little standpipe located near the engine base. From the standpipe the oil is withdrawn by the pump E and delivered at high pressure to the spraying nozzle by which it is atomized and driven into the combustion chamber. The air for spraying the oil is furnished by a two-stage air compressor shown at C, Fig. 2. The first stage of compression reaches a pressure of 150 pounds per square inch. The air is then delivered to a storage tank and is available for starting the engine. The second stage of the compressor is of small capacity and handles only enough air to spray the oil from stroke to stroke, the amount of air being regulated by a valve placed in the air-inlet pipe and controlled by the governor.

The vaporizer is one of the special features of this engine. It is shown in Fig. 3. It consists of a massive gun-iron thimble heavily ribbed on the inside to increase its surface and provided with a loose flange and copper gasket by which it is bolted to the engine. It is located on the inside of the cylinder head and opens directly into the combustion chamber, being maintained at a suitable temperature by the combustion of the fuel. The fuel is instantly ignited when the spray valve is opened and it is injected into the combustion chamber. The point of ignition can therefore be exactly timed and relatively high compression may be used without danger of pre-ignition.

On the second outward stroke of the engine the expanding gases drive the piston forward and on the following return stroke the exhaust valve B is opened and the products of combustion are expelled.

This engine runs satisfactorily with all grades of petroleum, even including the California crude oils which contain a large percentage of asphaltum. The consumption of fuel oil is guaranteed not to exceed 0.6 pounds per horse-power-hour at full load and 0.75 pound at one-quarter load, and results have been obtained as low as 0.4 pound.

The expense for maintenance is said to be very low. This high efficiency is

obtained through perfect combustion at all times regardless of the load. At every suction stroke a predetermined volume of air is drawn into the cylinder. When the engine is fully loaded all of this air is necessary for proper combustion. When the load is light the excess of air insures high combustion efficiency and it also acts as a cushion which during the succeeding stroke returns the absorbed energy to the engine. The combustion is so complete that no carbon is deposited except a thin coating in the vaporizer, which runs indefinitely without attention.

The speed is regulated by the governor G which alters the length of the stroke of the oil pump E. This is done by shifting the point of contact between the pump lever and its actuating cam. The speed variations are guaranteed to be within two per cent for small variations of load and within five per cent from no load to full load.

The compression in this engine is comparatively moderate and a special device is provided whereby the air pressure required for starting is reduced to less than 150 pounds. The amount of cooling water required is three gallons per horsepower-hour and the water may be discharged at a high temperature.

The advantages claimed for this engine are low fuel expense, simplicity, low attendance charges, absence of excessively high pressures, simplicity of handling fuel, and absence of refuse. The engine is manufactured in sizes from 85 to 350 horsepower.

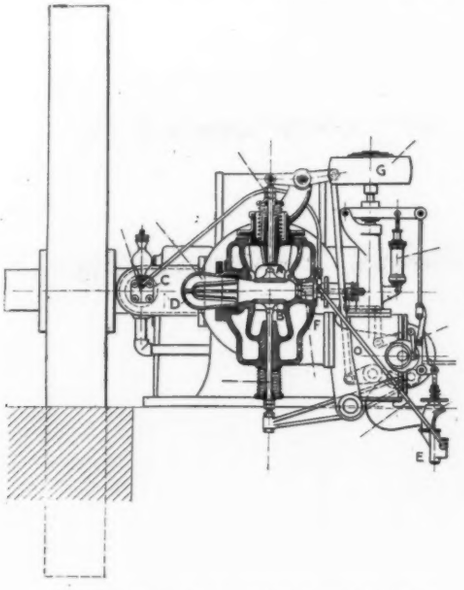


FIG. 2.—DIAGRAM OF ENGINE MECHANISM.

FIG. 3.—VAPORIZER.

Western Electric Exhibit Honored at Brussels.

The pioneer telephone manufacturing company in Belgium is the Bell Telephone Manufacturing Company, located at Antwerp, which entered the field in 1882, only a few years after the invention of the telephone. The European governments today are using to a great extent the efficient telephone apparatus developed along purely American lines, and it is largely due to the efforts of the Bell Telephone Manufacturing Company and the other European houses of the Western Electric Company that the equipment of the European telephone system conforms to the standards of this country.

At the International Exposition recently held at Brussels the Grand Prix for its exhibit in the class of electrical apparatus and appliances was awarded to the Bell Telephone Manufacturing Company. At the exposition this company occupied a large space in the Belgian section, being located next to the exhibit of the Telegraph and Telephone Department of the Belgian Government, whose requirements it has filled from the beginning. The exhibit included many types of apparatus manufactured at the Antwerp factory. Among these were telephone sets of many descriptions, small type switchboards, as well as a large common-battery exchange in complete working order with its necessary power plant, frames and racks. Miscellaneous telephone apparatus was also shown.

Kellogg Telephone Installaion.

An interesting installation made by the Kellogg Switchboard & Supply Company for the city of Chihuahua, Mex., is a complete exchange with an ultimate capacity of 1,800 magneto multiple lines.

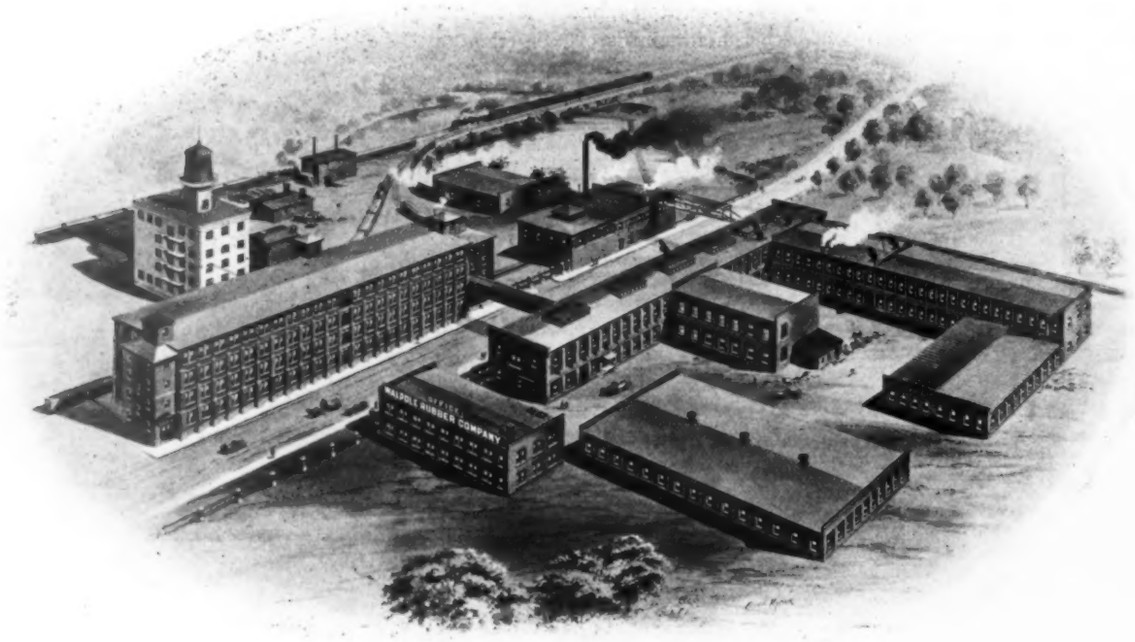
The present equipment will be 800 lines, combined drops and jacks. There will be three sections, five operators, each equipped with fifteen double lamp-supervision cord circuits with ring-back keys, single party. There will be a one-position combination chief and toll desk, equipped for ten toll lines, one wire chief's turret equipment complete, and one main distributing frame, equipped with 800 arresters and terminal clips for 1,350 outside lines. The power plant will be furnished complete as follows: Two sets of eleven-cell storage batteries, one motor-generator charging set and power switchboard.

Enlarged Plant of the Walpole Rubber Company.

The present business of the Walpole Rubber Company began in 1892 with the manufacture of liquid electrical insulation in a small plant in South Boston, Mass., under the name of the Massachusetts Chemical Company. In 1900 the company having outgrown the South Boston plant bought a plant in Walpole, Mass., and then added to the business the manufacture of rubber soles and heels for shoes. In 1908 the Walpole Shoe Supply Company was

organized for the manufacture of shoe supplies in which rubber is incorporated. Nearly coincident with the starting of the shoe-supply business the company entered into the manufacture of rubber syringes, automobile horn bulbs, rubber heels for horses and inner tubes for automobile tires.

To care for the increasing business in the various lines already specified, the individual organizations manufacturing these products were, in 1910, brought together under the name of the Walpole Rubber Company, Walpole, Mass. The company owns about fifty acres of land in Walpole alongside the New York, New Haven & Hartford Railroad.



PLANT OF THE WALPOLE RUBBER COMPANY, WALPOLE, MASS.

To the original plant, additional buildings, carefully designed and provided with every facility for economical manufacture, have recently been added. The largest of the new buildings is of mill construction. The ground floor is of concrete, carefully surfaced. The building is equipped throughout with automatic sprinklers and provided with separate brick walled staircase and elevator wells. Throughout the entire plant the most modern and efficient machinery has been installed.

In the accompanying illustration is shown a view of the present plant of the Walpole Rubber Company.

Alternating-Current Engine-Type Generators.

A line of low-speed, sixty-cycle, engine-type alternators embodying a number of new features of design has been recently placed on the market by the Westinghouse Electric & Manufacturing Company. The line covers capacities from 50 to 1,100-kilovolt-ampere, two-phase or three-phase, and standard voltages of 240, 480, 600, 1,200 and 2,400 volts. A striking characteristic of the entire line, as shown by the machines already in operation, is the ability of the generators to successfully carry commercial loads of low power factor.

As the general construction and arrangement of parts of the revolving-field generator is familiar to all, this description will be confined to the new features of this design, known as the type E.

The stator frames are of such design as to give great rigidity and plenty of freedom for the end connections of the armature winding. At the same time the construction is economical of material and affords excellent ventilation. The frame consists of a one-piece casting, except in sizes of such diameter that a split frame is a necessity for shipping reasons. In such cases the halves are bolted firmly together, making practically a solid frame. The frames of the smaller sizes are provided with slide rails on which the frame can be shifted to expose the rotor.

The armature core is built up of laminations of japanned steel of good magnetic characteristics. The laminations are dove-tailed in recesses in the frame. They are assembled under pressure and securely held by finger plates and end plates. Generous ventilating ducts are provided in the core to maintain uniform low temperature. The teeth are firmly supported at each end of the core by finger plates.

Repairs to the armature winding are very easily made because of the design of the winding. The armature slots are open and the coils are held in place by wedges. The coils are entirely interchangeable and are completely formed and insulated before assembling in the core.

The end bells provided for the protection of the armature winding and attached to the end of the frame are of segments built up into circular form and so bolted together that they are light and open, yet rigid and indestructible.

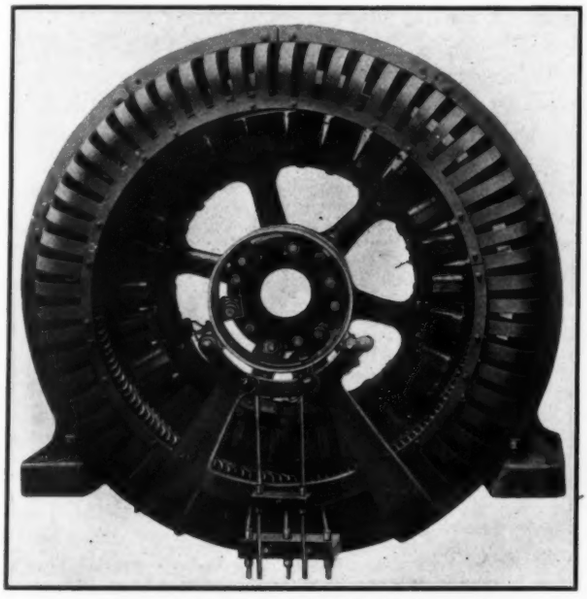
The brush-holder brackets, except in the larger sizes, are bolted to the armature frame, which makes each generator complete in itself. On the larger sizes, however, the brush holders are mounted on a pedestal which is to be

bolted to the engine bed plate. At least two brushes are provided for each collector ring, which makes it possible to adjust any brush without opening the field circuit.

The rotor consists of a casting with laminated pole-pieces bolted on. The proportions of the casting are worked out with special reference to cooling strains, and the material used provides a homogeneous magnetic circuit. Edgewise-wound strap is used for the field coils of all type E generators. The insulation between turns is of fire-proof quality. The entire design of these generators is arranged for thorough circulation of the air.

The field poles of type E generators are so designed that a cage damper winding may be used when desired. Such a winding consists of a series of copper bars embedded in the pole faces, with the ends short-circuited like the squirrel-cage winding of an induction motor. The winding serves as an effective damper to any fluctuation and thus tends to prevent "hunting." The cage-damper winding is not essential to satisfactory operation, however, when modern steam engines are used as the prime mover. Where internal-combustion engines are used the cage-damper winding is advisable.

The collectors are of the spider type, consisting of two machined cast-iron rings mounted on a cast-iron bushing or hub, from which they are carefully insulated.



TYPE E GENERATOR—COLLECTOR END.

BRUSH-HOLDER BRACKET STAND.

MERCURY-FLOTATION METERS.

FOR STREET-CAR AND ELECTRIC-VEHICLE SERVICE.

Recognizing the growing demand for a suitable street-car meter, which can be installed and operated with minimum attention, the Sangamo Electric Company, Springfield, Ill., placed on the market the meter illustrated herewith, after making exhaustive tests in regard to the amount of jarring, pounding and vibration which the mercury-floated meter system would withstand.

During the past two years the mercury-flotation type meter has been in continuous service on electrically lighted steam railroad cars on practically every large railroad system in the United States. The meters have withstood the rough usage, jars, shocks, etc., without the slightest injury.

A further demonstration is the successful use of mercury-flotation meters on motor trucks handling freight, and on electric pleasure vehicles. This service is unusually severe, as the combination of solid tires with rough cobble stones, imperfect paving, rough roads, etc., produces an excessive amount of jar and shock.

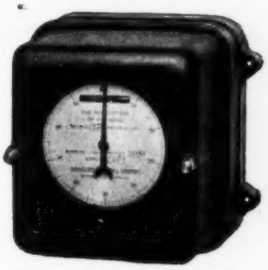
Street-car service was also successfully met, and the results have been so satisfactory that a complete line of meters designed especially for street-car service has been produced.

In general, the mercury meter consists essentially of a disk-like motor element partly or entirely submerged in mercury, so that current can be led in and out from this element by the mercury, through fixed metallic contact sets in the walls of the chamber containing the mercury and disk. The reaction of current passing radially or diametrically across the armature—with a magnetic field properly set with respect to the armature—will cause rotation, and this rotation will be proportional to the amount of current passing through the armature.

As will be noted the registering dials are five in number; four small and one large dial, all reading in kilowatt-hours. The four small dials perform the usual functions of totaling up the entire current consumption, readings being taken at any desired interval. The large dial and pointer are known as a trip register, and the gearing is so proportioned that current consumption per trip, or per day, if desired, causes the pointer to travel over practically the entire circle. This long pointer can be reset by removing the seal cap on a reset mechanism and inserting a small key. When it is desired to eliminate the use of keys the meter is provided with a small push button reset mounted on the case.

Before starting out a car, the inspector sets the long hand to zero and upon completion of the trip or day's run the value of the register is noted in the inspector's record book, after which the hand is again reset to zero

WATT-HOUR METER.



AMPERE-HOUR METER.

position, ready for the next run. This resetting of the trip or day registering hand in no way affects the registering of the small dials, which total the entire amount of energy consumed.

The advantage of this fast moving reset pointer is obvious, as the amount of power required each day can accurately be determined, the motorman is constantly checked as to his skill in handling the equipment, and the inspector has a definite basis on which instructions tending to better the service can be based.

The Sangamo ampere-hour meter as designed for use on electric vehicles, is practically a Faraday motor, as applied to meter purposes. The operation of this meter is the same as the watt-hour meter described above. For use on electric vehicles the ampere-hour meter is equipped with a differential shunt which enables nec-

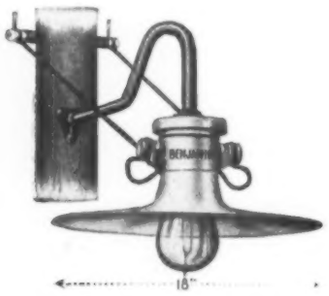


FIG. 1.—FIXTURE NO. 1521.

essary overcharge being given the battery each time it is charged, without manipulation of the meter on the part of the operator. The differential shunt consists essentially of two current-shunt elements within the meter, each connected in a special way and with an adjustable element, so that the meter will run slower on charge than on discharge. A view of the Sangamo ampere-hour meter is shown in one of the accompanying illustrations.

New St. Louis Quarters for Western Electric Company.

Announcement is made that the Western Electric Company has signed a ten-year lease on a new five-story building, costing $100,000, to be built at the corner of Eighth and Spruce Streets. The new building will occupy a lot 100 by 135 feet and will contain 60,000 square feet of floor space. It will be completed early in 1912.

High-Voltage Street-Series Lighting Units.

The Benjamin Electric Manufacturing Company, Chicago, Ill., is placing on the market a line of high-voltage street-series lighting units which are attracting considerable attention. Representative fixtures and sockets are shown in the accompanying illustrations.

FIG. 2.—STREET-SERIES CUT-OUT SOCKET.

The socket itself consists of essentially three porcelain parts, namely a central or body portion with integrally-formed knobs; a lower removable bushing carrying the threaded socket shell and film cutout spring; and a surmounting petticoat insulator.

The base portion has a center bore in which are located the center spring and short-circuiting contact, together with means for co-operating with the lower or removable portion. Beneath the knob are grooves forming protected and insulated passages for the wires. On the upper side of the base there is an iron fitting supported by four screws deeply counter-sunk in the porcelain. Between the two is a rubber disk. The lower part may be inserted by merely pushing it forward and turning to the right, or removed by pulling it outward and turning to the left. It

FIG. 3.—FIXTURE NO. 1581.

cannot become disconnected by turning the lamp. The petticoat insulator is held in position by a lock nut and washers passing over the upper end of the fitting, thus making a water-tight joint. The device is thus a combined socket, cross-arm, and insulator with three distinctive features: (1) compactness; (2) strength; (3) high insulation.

For the purpose of insulation provision is made for span-wire suspension, and for gooseneck or other three-fourths-inch pipe connections by means of special fitting. The reflectors used are thoroughly insulated from the support. They are attached by four screws passing through holes cemented in the back. Fig. 1 shows an eighteen-inch flat-cone reflector; Fig. 2, an eighteen-inch radial-wave reflector; Fig. 3, an eighteen-inch flat-cone reflector incorporating a globe holder, and an 8 by 6.5-inch glass globe. Fig. 4 shows a street-series film cut-out socket.

New Magnetos.

The Connecticut Telephone & Electric Company, Meriden, Conn., has placed on the market for 1911 several new types of its high-tension magnetos for automobiles.

The new dual type is worthy of spe-

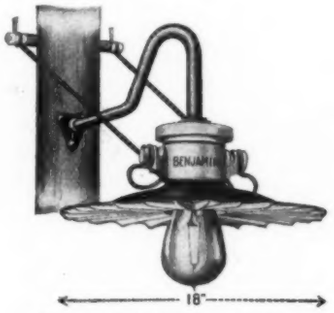


FIG. 4.—FIXTURE NO. 1491.

cial mention. Types A-4 and A-6 can be arranged for a clean dash; that is, no coil on the dash is used. The secondary or transformer winding is inclosed in cartridge form which screws flush into the bow of the magnets, so that it can be removed or replaced by a new one just as easily as a unit in the Connecticut spark coils. The dual system is also furnished with a powerful starting vibrator button on the switch. Simplicity has been the keynote in designing this magneto and an examination discloses, besides workmanship of the highest character, many desirable and exclusive features not found in any other magneto as, for instance, withdrawal without tools of the interrupter with housing for cleaning or adjusting, removal of the distributor cover and arm with brush, spark-gap windows through which missing of any one plug may be ascertained, also many other points of high class construction.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, FEBRUARY 3.—The announcement is made of the appointment of C. A. Park as managing director of the British Westinghouse Electric Company. Mr. Park is the late superintendent of the London & North Western Railway Company, and has been described as the greatest living authority on rolling stock.

The London Electric Railway Company, which is the new name for the Yerkes group of tube railways in London, is now building a moving staircase at the Earl's Court station. The installation is an experimental one, designed to ascertain whether the British public will view the escalator in the same manner as Americans and the French. The moving staircase now being installed can deal with about 9,000 passengers an hour.

An association called the "Electric Power Users' Association" has been formed in London, the objects of which are to test and examine periodically for faults in electrical machinery as a preventive against breakdown and stoppage, to advise generally as consulting engineers; to undertake insurance of electrical machinery, and to grant certificates of inspection as required by the leading insurance companies. The movement appears likely to meet with some opposition, it being pointed out that it will enable a small band of consulting engineers to adopt commercial methods of obtaining business which individual consulting engineers are debarred from doing under the rules of etiquette issued by the Institution of Electrical Engineers, and by which they are bound.

Recent official figures show that there are now 300 tramway undertakings in the United Kingdom, of which 176 are owned by local authorities, and 124 by companies. Since the year 1878, the route mileage of all these undertakings has increased from 269 to 2,562; the capital expenditure from $21,036,750 to $369,708,250; the number of passengers carried from 146 million to 2,743 millions, and the net receipts from $1,154,750 to $24,718,900. The number of passengers carried in the year 1909-10 is equal to about sixty-two times the estimated population of the United Kingdom.

The India office has just concluded a contract with Marconi's Wireless Telegraph Company, Ltd., for the erection of wireless telegraph stations on the Marconi system at Calcutta, Delhi, Allahabad and Simla. These stations will be used primarily for the military and other Government purposes, and it is hoped that they will be completed in time for the Durbar. The range of the Stations at Calcutta, Delhi and Allahabad will be six-hundred miles, and that of the Simla station three hundred miles. The total cost of this enterprise will amount to $250,000. So far, wireless telegraphy has not been developed to a large extent in the Indian Empire. Short-range stations have been at work on the Hooghly, at Bombay, in the Andaman Islands, and also in Burma. This contract represents a development which is particularly striking in view of the fact that it embodies the first extensive use of wireless telegraphy for inland communication. The Italian Government uses the Marconi system to a limited extent for the transmission of messages overland, but the most conspicuous example of inland wireless telegraphy is that organized in connection with the Madeira-Mamore Railway. A Marconi station was erected at Manaos and another at Porto Velho—540 miles distant. These stations have been at work for some time in a most satisfactory manner in spite of the severe atmospheric conditions which are supposed to make wireless telegraphy in tropical countries a practical impossibility. Their efficient operation is an excellent augury for the success of the unique enterprise upon which the Indian Government has now embarked. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, FEBRUARY 3.—Among electric traction projects in the region of Paris, I note that several communes on the Paris-Sceaux and Paris-Limours steam railroad lines have organized to promote the electrification of these lines. Another steam railroad which is to be changed over is the line running from Lens to Lievin, in the channel region. A new electric traction line is to be installed between Maisons Laffitte and Enghien in the suburbs of Paris.

Prof. E. Branly and Madame Curie were both candidates for the vacant chair in the Academy of Sciences, hence the election was an unusually interesting one. Dr. Branly was elected by a very close majority.

Among recent French projects may be mentioned a hydraulic plant situated at Volcanville and another to be erected at Arreau, in the Pyrenees region. The town of Bron has made a contract with the Rhone Power Company for its supply. A local company is to furnish the current for the town of Remiremont.

At the Saarbrück mines in Germany there is installed a steam plant of some size, containing ten boilers with superheaters and three turbine-alternator groups of 4,000-horsepower size. The present station is laid out to run in parallel if need be with the neighboring Heinitz plant, this latter being operated by blast furnace gas engines.

The electric plant of Göttingen is to double its output in order to keep up with the demands, and this will require an outlay of about $325,000. Cologne is to have an increased supply of current for public use and a contract has been made to this effect with one of the large German firms. One of the stipulations is that the boilers are to use lignite fuel, this being abundant in the district about the city. The plant will commence running in 1912.

After a close competition with European and American firms, the Siemens & Halske Electric Company secured the contract for the increase in the Bukharest telephone exchange, which is under government control.

Single-phase current will be used on the new railroad running from Innsbruck to Reutte, Austria, and the current will be taken from a hydraulic plant on the Rutzbach stream over a 50,000-volt power line. For the railroad use there will be installed four substations at Reith, Griessen, etc., which will reduce the voltage to 10,000 volts. Locomotives of the Dessau-Bitterfeld type are to be used, these being fitted with 800-horsepower motors. The Union Electric Company of Vienna has charge of the electrical work. The same type of locomotive will be used on the new Vienna-Pressburg electric railroad, also working at 10,000 volts. Current comes from the Vienna electric plant. This line is among the principal in Austria, being about forty miles long. Of this, some tweive miles consist of traction lines within the city limits of both places, and on these sections direct current will be used, reserving the single-phase high-voltage current for the interurban part of the road. A. DE C.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, MAN., FEBRUARY 10.—The Manitoba Telephone Commission is having plans prepared for a fully modern telephone exchange to be erected here this spring.

The municipal street railway system at Calgary, Alberta, has reported exceptionally good earnings. During January the net earnings were $18,988, an increase of $7,551 over the same month a year ago. The total number of passengers carried during the past month was $464,754. City Engineer Arnold, of Lethbridge, Alberta, was sent by the City Council to look into street railway conditions in various cities on this continent. It had been suggested that an electrc railway be built in that town but the Council thought it best to wait for a year or two. However, after what he saw in other places the city engineer advises the immediate construction of the proposed systems despite the fact he found that street railway systems do not pay in cities of less than 25,000 population.

The City Council of Calgary, Alberta, has voted $6,000 for improvements and extensions to the fire-alarm signal service. The city electrician is now preparing the specifications.

The British Columbia Telephone Company is stringing an additional copper wire between New Westminster, B. C., and Blaine, Wash. This was necessary on account of the large increase in business over the line during the past few months.

The Dee Line Rural Telephone Company, which operates a telephone system near Abernethy, Saskatchewan, held its annual meeting a few days ago and re-elected the old board of directors. It was also decided to build several extensions this year and refit portions of the line. Address R. D. Moonie, Abernethy, Saskatchewan, for information.

A great extension of telephone train dispatching on the Canadian Pacific R. R. system will be undertaken this year, authority having been given for the equipment of 1,528 additional miles. This will make a total of 3,782 miles of telephone train-dispatching circuits on the system, covering the lines from Kamloops, B. C., to Quebec City Que. K.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

200,000 HORSEPOWER FOR ATLANTA.—Waterpower sites have been secured, and $10,000,000 capital is at hand to furnish 200,000 horsepower to Atlanta, Ga., and the surrounding territory, according to a recent report. The necessary plants are to be completed within the next eighteen months and the power will be ready for consumption by the summer of 1912. The company has acquired power rights at Tallulah Falls, which will furnish 100,000 horsepower. Plants also will be erected at Gainesville, and at Franklin and other points, which will furnish another 100,000 horse-

power. A great distributing station is to be built at Tallulah Falls, where six generators, each developing 5,000 horsepower, will be installed.

FOR DEVELOPMENT IN ALABAMA.—A bill has been introduced into Congress providing for the improvement of navigation on the Black Warrior River in Alabama, in exchange for power rights to be given to the Birmingham Water, Light & Power Company. The Light & Power Company is in turn to give certain aid to the Secretary of War in the improvement of the waterway and construction of the locks, and will then secure for ninety-nine years the privilege of operating electrical power stations and other structures. The Company is to provide the Government with all necessary power and lights at the locks, and shall also pay rental at the rate of $1.00 per annum for each horsepower developed from the water wheels. F.

PROPOSED BOND ISSUE FOR DEVELOPMENT OF TEXAS PROPERTIES.—A bill is at present before the Legislature of Texas providing for the issuance of $50,000,000 in bonds for carrying out reclamation and conservation work. All through West and Southwest Texas are "dry" streams, called arroyos, which at certain seasons are taxed to carry off the flood waters. By the construction of dams across these gulches and running streams an ample supply of water for all purposes for the respective localities may be obtained. It is claimed that by carrying out this land reclamation project the state would profit enormously by the enhancement in taxable values the works would cause and besides serving the purpose of providing water for irrigation and other purposes, these dams and storage reservoirs would enable the establishment of hydroelectric plants. D.

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

A proposal for the equipment and operation of an independent city-built rapid-transit system was submitted to the Public Service Commission of the first district by Frank J. Sprague, Oscar T. Crosby and associates. The proposition was put before the city so that in case the present Interborough proposals should be withdrawn there would still be an independent scheme under consideration. The plans include a four-track, one-level subway from Times Square and Forty-fifth Street down Seventh Avenue, and an extension through Church Street to Liberty Street with two tracks to the Battery; a four-track cross-town connection through Thirty-fourth Street from Seventh Avenue to Lexington Avenue; a four-track extension from Thirty-fourth Street up Lexington Avenue to One Hundred and Thirty-eighth Street, with connections for future extensions; and a two-track extension from Liberty Street through separate tunnels under the East River to Flatbush Avenue. The plans provide for leasing the subway to an independent operating company.

The Public Service Commission, first district, made public a tabulated statement showing the ticket sales at every station on the subway by years from 1904 down to the year ended December 31, 1910. In 1905, the first full year of operation, the ticket sales for the entire system aggregated 116,209,313, and in 1910 the total sales aggregated 270,321,490. Despite its falling off in ticket sales, Brooklyn Bridge station continued to lead all the stations of the subway in 1910 with a total of 16,688,028.

COMMISSION NEWS FROM WISCONSIN.

(Special Correspondence.)

The City of Neenah has won a contest before the Commission that has had wide attention for more than a year. Both the Wisconsin Traction, Light, Heat & Power Company and the Wisconsin Electric Railway Company operate interurban lines between Neenah and Menasha. The Wisconsin Electric Railway Company is the only road which runs through Neenah from one end to the other, while the other road operates its lines only a short distance within the city limits. In traveling from one end of the city to the other it was necessary to pay two five-cent fares, one on each road. The City contended that the double fare was inequitable and that if the joint rate with transfer privileges was substituted for it, the increased business would justify the increased rate. The companies contended that their franchises called for a five-cent fare within the city limits and refused to grant the joint rate. The Commission overruled this objection on the authority of the decision of the Supreme Court in the recent case of the Manitowoc & Northern Traction Company vs. the City of Manitowoc, in which it was held by the Court that the Commission had the power to abrogate the contract rights of a franchise when such contracts were found to be unreasonable.

The arguments in the application of the Kenosha Electric Railway Company for a certificate of public convenience and necessity have been heard by the Commission. This case has attracted considerable attention because of a recent decision of the Supreme Court in the matter of the constitutionality of the indeterminate-permit provision of the public utilities law under which the Commission acts. The Kenosha Gas & Electric Company and the City of Kenosha were unable to agree as to rates for street lighting and the city granted a franchise to the Railway Company to do a street-lighting and commercial-lighting and power business in Kenosha.

The Gas and Electric Company surrendered its franchise from the city and took an indeterminate permit from the state and then claimed that the Railway Company was barred from doing a lighting business in the city. On carrying the appeal to the Supreme Court the Railway Company was defeated and now the city and the Railway Company have united in requesting the Commission to grant a certificate of convenience and necessity which will permit the Railway Company to light the streets of Kenosha and do a general lighting and power business also. It is contended by the petitioners that the Gas & Election Company has given poor service and that the Gas & Electric Company is unable to give rates as low as the Railway Company will be able to furnish, and that for this and other reasons the Railway Company should be permitted to compete with the Gas & Electric Company in the city. In the testimony given in the case before the Commission the following table was submitted:

COMPARATIVE COST OF CURRENT PER AVERAGE KILOWATT HOUR GENERATED.

	Fixed Charge.	Operating Expense.	Total Cost.
Kenosha Gas and Electric Company:			
Year ending Jan. 1, 1908	$0.0353	$0.0338	$0.0691
Year ending June 30, 1909	.0363	.0348	.0711
Year ending June 30, 1910	.0334	.0335	.0669
Kenosha Electric Railway Company:			
Aug. 20, 1909—June 30, 1910	.0104	.0179	.0283
With equipment now being installed	.0196	.02	.0396
With new turbine room	.0214	.0193	.0407
With commercial light and power franchise.	.0187	.0173	.0360

Fixed charges includes interest on investment, depreciation and taxes. Operating expenses include all items of operating expense reported to Railroad Commission.

LIGHTING AND POWER.

(Special Correspondence.)

AFTON, IOWA.—A vote will be taken on the installation of an electric light system. C.

CHAPPELL, NEB.—This city will vote on the establishment of an electric light plant.

NAPLES, TEX.—M. H. Sullivan, Jr., and Charles E. Grant will erect an electric light plant.

SPEARVILLE, KANS.—Ira Hickman and others propose to establish an electric light plant here.

KIRBYVILLE, TEX.—J. W. Fleming and J. Morton are considering the erection of an electric light plant.

MONTICELLO, ARK.—The municipal electric light plant has been damaged by fire to the extent of $15,000.

HELENA, ARK.—The Helena Gas & Electric Light Company has been incorporated with a capital stock of $300,000.

EDMONTON, ALTA.—The city is planning the expenditure of $50,000 for the installation of a generator, plumbing, etc. C.

HEAVENER, OKLA.—The Degnan-McConnell Coal Company of Wilburton contemplates installing an electric light plant here.

WEST CHESTER, PA.—The East Bradford Light, Heat & Power Company has been incorporated with a capital of $5,000.

DE SOTO, MO.—The Consumers Electric Light & Power Company has been granted a twenty-year franchise to operate here.

LIBBY, MONT.—The Libby Water Works, Electric Light & Power Company will complete the improvements on its lighting system in the spring. C.

CAMPBELLSPORT, WIS.—The Campbellsport Electric Light & Power Company has increased its capital stock from $10,000 to $40,000. C.

CADDO, OKLA.—The Caddo Power Company has been incorporated by J. R. Hartzhog, D. M. Wilson and P. C. Karver for $6,000.

BLUE MOUND, ILL.—Luther C. Nichols has sold the electric light plant here to Frank L. Suffern of Decatur who already has assumed charge. Z.

MANISTEE, MICH.—On April 3 the voters will consider the proposition of voting $90,000 for the purpose of erecting a municipal lighting plant.

GRANGEVILLE, IDA.—The Idaho Realty & Power Company announces that it will begin the installation of a power plant here, within two months. A.

PRYOR, OKLA.—The Pryor Ice & Light Company has been incorporated by W. L. Jones, O. O. Snyder, W. H. Oliver and J. C. Martin, for $50,000.

RIDGEFARM, ILL.—The Ridgefarm electric light plant has been sold by T. E. Davis to the Georgetown Electric Company which takes charge at once.

KIRBYVILLE, TEX.—A plan to supply this place with electric lights and electric power for a planing mill is being considered by J. W. Fleming and Julius Morton.

INTERNATIONAL FALLS, MINN.—Congress has authorized the Rainy River Improvement Company to build a dam at the outlet of Nama Kan Lake, at Kettle Falls. C.

MONTICELLO, ARK.—This town is to have a new electric light plant to replace the one which recently burned. Present

plans call for the expenditure of between $12,000 and $15,000. Two generators will be installed.

ARDMORE, OKLA.—Edward S. Perry, of Coalgate, Okla., plans the establishment of a waterpower electric plant here.

CHATTANOOGA, TENN.—The Chattanooga Armature Works has completed plans for a shop building.

SAUK RAPIDS, MINN.—The bill authorizing the construction of the Sauk Rapids dam has been passed and it is expected that construction will be started this spring. C.

SAN FRANCISCO, CAL.—The Leitch Electric Company has been incorporated by Chas. A. Leitch, Warren Vance and D. A. Turnbull, with a capital stock of $25,000. A.

LITTLE ROCK, ARK.—It is reported that the electric light plant will soon be in complete operation. This plant is taking the place of one formerly in operation here.

PLYMOUTH, IOWA.—Business men are considering the advisability of constructing a concrete dam across the Shell Rock River to furnish water power for lighting. C.

NORTH BRANCH, MINN.—Mr. Spivak is organizing a company with a capital of $50,000 for the installation of an electric light plant for this and surrounding towns. C.

INDIANAPOLIS, IND.—The Royse Electric Company has changed its name to that of the Indianapolis Electric Company and increased its capital stock to $70,000. S.

HELENA, MONT.—The Helena Gas & Electric Company was recently incorporated by C. F. Fitzpatrick, James B. Miles, Leo J. Mondt and W. J. O'Brien, with a capital of $300,000.

SANDOVAL, ILL.—Mayor Joseph Thomas, and Aldermen M. R. McCall and W. J. McNally are inspecting electric light plants preparatory to the installation of a municipal plant here. Z.

MINNEAPOLIS, MINN.—The Jordan Lighting Company has been incorporated with a capital of $30,000 by Lebert E. Jordan, Arthur S. Grogan and Marcus H. Thorson, all of this city.

VALENTINE, NEB.—The new city dam, which has been in course of construction for the last six months, is rapidly nearing completion. The city will immediately put in its own street lights.

PORTLAND, ORE.—The date of completion of the Portland Railway Light & Power Company's plant at Estacada is set at October 1. The plant will have a generating capacity of 20,000 horsepower.

ELY, MINN.—The White Iron Lake Iron & Water Power Company is planning the construction of a power dam and hydroelectric plant at the outlet of White Iron Lake, to develop 25,000 horsepower. C.

AUSTIN, NEV.—The Maricopa Company is making rapid progress on the work of grading for the power and lighting plant. Electric power will be used to operate some of the hoists at the mines.

CHICO, CAL.—Local capitalists have purchased a site of 165 acres on Deer Creek and plan the erection of a power plant there. T. N. Nash, of this city, is one of the men interested in the project. A.

COLUMBUS, MO.—The laundry which is to be installed at Parker Hospital will be completely equipped with electrically driven machinery. The work of installation is to be done in a short time.

MEDFORD, ORE.—Harry C. Stoddard, superintendent of the Rogue River Electric Company, announces that his company will early in the spring build a new power plant at Rogue River Falls, near Prospect. A.

OROVILLE, CAL.—H. H. Sinclair, manager of the Great Western Power Company, announces that another unit is to be added to the Big Bend plant of his company this year, at the approximate cost of $200,000. A.

LINTON, IND.—The Vandalia Coal Company is installing electric machines in Mine No. 21. Electric drills are to be put in and electric power will be used for hoisting the coal and lighting the mine and buildings. S.

SYLVIA, KANS.—The new electric light plant will be ready for operation, it is expected, by March 1, and arrangements are now being made to hold a municipal celebration that night when the lights are turned on.

FORT LAUDERDALE, FLA.—Henry Brown, J. L. Billingsly and others are constructing a new ice and electric light plant here. The operating company will be known as the Fort Lauderdale Ice & Light Company.

HANKINSON, N. D.—H. G. Squires, of Galesburg, Ill., has applied for a twenty-five-year franchise for operating an electrical light plant here. The sentiment seems to be almost unanimously in favor of having the plant.

NORTH BREWSTER, O.—The North Brewster Electric Light, Heat & Power Company, with a capital stock of $5,000, has been incorporated by J. P. Thomas, William Glick, William P. Soule, W. D. Fairfax, D. A. Young and J. D. Waterbury.

LAFAYETTE, IND.—The Sterling Electric Works has been incorporated with a capital stock of $200,000, to manufacture electrical appliances. The directors are S. T. Murdock, Thomas Duncan, R. B. Wallace, Julius Berlowitz and Thomas Bauer.

CLEVELAND, O.—The Brookins Company has been incorporated with a capital stock of $50,000 to make and sell electric light and gas fixtures. The incorporators are Fred J. Klingman, C. S. Brookins, W. B. Chapman, Burton D. Umhall and H. M. Wilkins.

PASCO, WASH.—It is reported that work on the $500,000 distributing plant of the Pacific Power & Light Company will be started soon. With the completion of the plant Pasco will become the distributing center for power consumed in the Columbia and Yakima valleys.

DOVER, DEL.—The Milton Light, Power & Water Company was incorporated to furnish electric light, water and public supplies. The incorporators are: N. Wallace White, Oscar S. Betts, John M. Robbins and B. Frank Walls, all of Milton, Delaware, and the capital stock is $20,000.

ROSWELL, N. M.—The Berrendo Irrigation Farms Company, which bought out the Roswell Electric Light & Power Company last year, plans to spend $250,000 in improving the plant with additional buildings and new machinery. The work is expected to start within a couple of months. A.

COLUSA, CAL.—Three water appropriations, from which it is designed to furnish both power and irrigation to Colusa County, have been filed by Byron D. Beckwith. One claim is on Fresh Water Creek, one on Bear Creek in Colusa County, and a third on Cashe Creek in Lake County.

MARYSVILLE, CAL.—The Live Oak and Encinal Light & Power Company has been sold to Berg & Metz, of this city. It is understood that the purchase price was $10,000. The new firm purposes the extension of the lines and of furnishing light and power, not only to Encinal and Live Oak, but to all the farms and farmhouses in all directions.

CHESTERTON, ILL.—The Northern Indiana Gas & Electric Company of Chesterton has ordered two 3,750-kilovolt-ampere steam turbines from the Westinghouse Machine Company. The turbines will be connected to 750-kilovolt-ampere, 13,200-volt, three-phase, sixty-cycle Westinghouse generators.

WHITNEY, N. C.—The new owners of the Whitney Electric Development Company, have decided to resume work on the $3,000,000 hydroelectric plant. C. W. Smith, who was one of the company's receivers, has been placed in charge and instructed to complete the undertaking as soon as possible.

BOLEY, OKLA.—The Boley Light & Power Company has increased its capital stock from $5,000 to $20,000. J. O. Williams, J. R. Reynolds, H. Toyton, D. G. Gum, F. B. Armstrong, T. M. Haynes, J. H. McRiley, Miss C. M. Taylor, Dr. W. E. Foster, J. N. Brunett and W. M. Hazle are the incorporators

CHARLOTTE, N. C.—C. W. Smith, formerly one of the receivers of the Whitney Electric Development Company, has opened offices at Whitney and has begun negotiations for a resumption of work on the $3,000,000 hydroelectric plant at that place. Work will be rushed and the plant completed as soon as possible.

CHICAGO, ILL.—Enlargements of the Argo plant of the Corn Products Refining Company, amounting to $1,500,000 are to be made so that a greater efficiency in the use of fuel may be realized. The power plant will be increased in capacity from 6,000 horsepower to 12,000 horsepower, and turbines are to be used.

BASTROP, TEX.—W. B. Ransome and A. Griesenback have bought the stock of Dr. H. P. Luckett and Chester Erhard in the Bastrop Water & Light Company's plant, and the plant is now owned by W. B. Ransome, A. Briesenback and the T. A. Hasler estate. In the near future extensive improvements will be made and probably an ice factory put in connection with the plant.

INDIANAPOLIS, IND.—The plan to build a state power plant to furnish light and power to the state buildings has been revived by the donation of $200,000 for a hospital, by Dr. and Mrs. Robert W. Long. The cost of such a lighting plant as was projected would be about $105,300 and would, it is said, save the state about $10,000 yearly.

SAN FRANCISCO, CAL.—Articles of incorporation of the California Power & Manufacturing Company, capitalized at $5,000,000, were filed. The directors named are F. G. Baum, Charles W. Slack, C. S. Goodrich and John T. Pigott. The company proposes to own and operate water plants for power, lighting, irrigation, electricity and heating.

OGDEN, UTAH.—Transformers, oil switches, etc., have been received by the Utah Light & Railway Company for the improvements to be made in its plant at the mouth of Ogden Canyon. The company has also planned the construction of a steel-tower line from Ogden to Salt Lake and work on it will be started early in the spring.

RUMFORD FALLS, ME.—The Andover Power Company, for the development of water powers in the neighboring town of Andover, and use of the power for manufacturing purposes, has been organized here with a capitalization of $50,000. The directors are Richmond L. Melcher, James McGregor and Waldo Pettingill, all of this town, with Mr. Melcher treasurer and Mr. McGregor president.

SAN FRANCISCO, CAL.—At the annual meeting of the City Electric Company's stockholders, the following directors were elected: Mortimer Fleishacker, Herbert Fleishacker, L. Schwabacher, W. Arnstein, S. L. Napthaly, Wm. L. Gerstle, J. J. Mack, S. Scheeline and A. Schwabacher. A. Mack, who has been succeeded as president of the company by Mortimer Fleishacker, will leave shortly on an extended trip to Europe. A.

NORTH YAKIMA, WASH.—The cost of the improvements which are to be made by the Pacific Power & Light Company will aggregate about $210,000. The cost of the substation will be $35,000, improvements of the office building will cost $5,000, and the gas plant is to be remodeled at a cost of $75,000. The Naches power plant will have improvements costing $25,000, and $50,000 is provided for miscellaneous improvements.

BANGOR, ME.—Arthur B. Leach, of New York, and Linwood C. Tyler of Bangor, have applied to the Legislature for the incorporation of the Maine Power Company with a capital of not more than $1,500,000, and with the authority to purchase the Bodwell Power Company and to issue bonds for that purpose. The company's property is located at Old Town and Milford, thirteen miles up the Penobscot River from Bangor. It is estimated that the expenditure of $500,000 would put the plant in a position to operate successfully.

SAN FRANCISCO, CAL.—The United Light & Power Company, which, under the name of the Consumers' Light & Power Company, began supplying current from a plant in the basement of the Whitney Building a year ago, has just begun to operate three additional plants. The Equitable Light & Power plant in the Phelan Building has a capacity of 2,000 kilowatts in two units. The Southside Light & Power plant on Minna Street is equipped with a 2,000-kilowatt turbine generator. The Central Oakland Light & Power plant in Oakland has a present capacity of between 2,000 and 3,000 kilowatts in two units, and is already distributing current through several miles of underground mains. A.

AUSTIN, TEX.—The people of Texas, particularly of the upper Rio Grande valley, which is to be directly benefitted by the Elephant Butte dam and reclamation project, are much interested in the proposed amendment to the national reclamation act, allowing a lease of the power rights. As soon as the amendment is passed by Congress a company with a capital stock of $3,000,000 will be formed to install a hydroelectric plant in connection with the Elephant Butte project and construct electric power transmission lines down the valley of the Rio Grande to El Paso and other towns. The amendment gives the secretary of the interior authority to lease any surplus power or power privilege for a period not exceeding ten years, giving preference to municipal purposes. D.

ELECTRIC RAILWAYS.

(Special Correspondence.)

JAMESTOWN, N. D.—The construction of an electric line from the city to the State Hospital is reported. C.

BUTTE, MONT.—The county board has been petitioned for the extension of the street railway from Reagan's road house to the Five-Mile. C.

BELLINGHAM, WASH.—The Nooksack Valley Traction Company has secured $100,000 for the construction of lines to Blaine and to Sumas. C.

IRONWOOD, MICH.—The Gogebic & Iron Counties Railway & Light Company is about to commence the construction of an electric light plant and railway. C.

SUPERIOR, WIS.—The Duluth-Superior Traction Company is planning the expenditure of $400,000 in improvements on its system in Duluth and Superior. C.

VIRGINIA, MINN.—Work has been commenced on a survey for the construction of an electric road to Eveleth, Minn., by the Mesaba Electric Company. C.

WEBSTER CITY, IOWA.—Interurban and street railway construction is projected for this year. A central power station will be built at a cost of $40,000. C.

WAUNAKEE, WIS.—A vote will be taken on granting a franchise to the Wisconsin Valley Interurban railroad to construct its lines from Madison to Portage through the town. C.

ST. PAUL.—The St. Paul Railway Promotion Company has decided on the route for its line to Lake City, Minn. It will pass through Oakland, Highwood, Red Rock and Newport.

PARIS, ILL.—The Illinois Central Traction Company has secured a franchise and promise to build a line from Charleston to this place at once. The franchise is for a term of fifty years. S.

CHEHALIS, WASH.— The Chehalis & Cowlitz Railroad Company has been organized with a capital of $300,000 to construct an electric or steam railroad to a point twenty miles southeast of the city. C.

DANVILLE, IND.—Hoover Halton, who is promoting the Capital Circuit Traction Company has notified the Railroad Commission that work will begin on the line between Danville and Lebanon in a few weeks. S.

HUGO, OKLA.—A complete survey of the Hugo & Atoka Railroad will soon be made. About 75,000 of the stock has already been subscribed, and it is expected that grading will start in ninety days.

TWO ROCK VALLEY, CAL.—The ranchers of this district have presented a petition to the Petaluma & Santa Rosa Railway Company, asking that its line be extended from Live Oak, Cal., to this town.

MODESTO, CAL.—The South San Joaquin Improvement Company has applied for a franchise for an electric street car line in this city. Sealed bids will be received on this matter up to March 1, 1911. A.

CRESTON, IOWA.—The Creston-Winterset Interurban Railway Company has filed articles of incorporation with capital stock of $500,000 to construct an interurban railway from this city to Des Moines. Z.

ATLANTA, GA.—Officers named at a recent election of the Georgia Railway & Electric Company were as follows: President, P. S. Arkwright; vice-president, W. H. Glenn; secretary, G. W. Brine; treasurer, F. S. Mitchell.

KANSAS CITY, MO.—The Strang electric line, connecting Kansas City and Olathe, Kans., has been sold to the McKinley Traction interests. The Strang Company will extend the line to Lawrence and Topeka for the buyers.

PRESCOTT, ARIZ.—The Prescott Gas & Electric Company announces that the electric line between here and Miller Valley has been started and that within six months a number of new and important connections will be completed. A.

VALLEJO, CAL.—The officials of the Vallejo & Northern Electric Railroad Company announce that construction work on the proposed line between this city and Sacramento will be started soon and will be rushed through to completion. A.

HOUSTON, TEX.—The Houston-Galveston Interurban Electric Railway Company is preparing to start work on the construction of its extensive terminals here. The company will expend about $500,000 in these and other improvements in Houston. D.

SANTA BARBARA, CAL.—The Santa Barbara Street Railway Company has offered to abandon the low-power type cars it is now using and re-equip with high-power cars if the City Council will agree to take up the old franchise and grant a new one.

DALLAS, TEX.—The Texas Traction Company, now operating an interurban line from Dallas to Denison, will begin immediate construction of a line from Waxahachie, and later will extend to Hillsboro and on to Waco. The estimated cost is $1,500,000.

GALESBURG, ILL.—The City Council has passed an ordinance granting a twenty-year franchise to the Galesburg Railway and Light Company, the local branch of the McKinley system, for the use of the streets for a street railway. It has not yet been accepted by the Company. Z

LOS ANGELES, CAL.—Paul Shoup, manager of the Los Angeles Pacific Railway Company, announces that his company has leased from the Southern Pacific Railroad Company, that portion of the steam road extending west from Clements Junction to the city limits, and asked the Council's permission to electrify the road.

PETALUMA, CAL.—The Petaluma & Santa Rosa Electric Railway Company, of which E. M. Van Frank is president, has applied for a franchise for an electric line through this city. Point Pedro has been agreed upon as the terminus for the proposed road on which work will commence as soon as the franchise is granted. A.

DANBURY, CONN.—A final survey of the trolley line between Bridgeport and Danbury has been made and rights of way over which the new line will run are being purchased. Immediately upon the completion of the right of way construction will begin and it is hoped to have cars running on at least a portion of the line this year.

HAGERSTOWN, MD.—Maj. L. N. Downs and Hugh L. Kirby, promoters of the Hagerstown & Clearspring Electric Railway, which will be built this summer, are organizing the Trackless Trolley Company of Maryland and West Virginia, which will undertake to construct a number of trackless trolley lines in Maryland and West Virginia.

LEWISTON, ME.—The City of Auburn has granted the Portland, Gray & Lewiston Street Railways Company permission to change its location so as to run its cars nearer the city to connect with the Lewiston, Augusta & Waterville Street Railway. Under the change it will cost the Company more to complete the line, but it will shorten the running time of its cars.

BALTIMORE, MD.—There is a scheme under consideration for connecting this city with the Eastern Shore by trolley and to build lines through the section. The first line will be from Chestertown to Tolchester. For this purpose a company has been formed with a capital of $200,000, half of which has been subscribed. A right of way has been bought.

SACRAMENTO, CAL.—President John A. Britton, of the Pacific Gas & Electric Company, announces that his company has about completed plans for the extension of its electric lines in the suburban districts of this city. One extension will be running the street car service through Elmhurst, three miles from here. Work on the new improvements is expected to start early in March. A.

COLUMBIA, S. C.—The Duke interests are given the right in a bill introduced in the Senate to incorporate the Piedmont & Northern Railway Company, a $5,000,000 concern, that merges with the Greenville, Spartanburg & Anderson Railway Company, interurban railway lines being projected. The following are the incorporators: J. D. Duke, B. N. Duke, Samuel McRoberts, W. S. Lee, Ellison A. Smythe and Lewis W. Parker.

BEATRICE, NEB.—The Illinois Traction System proposes to construct and operate an interurban electric line between Adams and this place. The proposition provides that the company will construct and operate a power plant and railroad if stock in the institution to the amount of $300,000 is subscribed. The distance from Adams to Beatrice is about twenty-eight miles and the territory between the two towns is without transportation facilities.

AUSTIN, TEX.—A bill has been introduced in the Legislature authorizing the consolidation through purchase by the Texas Traction Company of Fort Worth of the property of the Denison-Sherman Interurban Railway Company. The latter company operates an interurban electric railway between Dallas and Sherman, Tex., a distance of sixty-five miles. The Texas Traction Company's interurban line runs between Fort Worth and Dallas. This is the first electric railway consolidation bill ever introduced in the legislature of Texas. D.

BELLINGHAM, WASH.—Practically $100,000 in subscriptions for the bonds of the Nooksack Valley Traction Company has been pledged here by business men. This subscription guarantees the construction of the first nine miles of the interurban line between this city and Ferndale. This company plans the construction of two interurban lines with an aggregate of mileage of sixty miles, one line running north from Bellingham to Lynden and from there northeast to Everson, Nooksack and Sumas, connecting at this point with the British Columbia electric, for Chilliwack and New Westminster. The other line will run northwestward from Bellingham, touching Marietta, Ferndale, Custer, and reaching the international boundary at Blaine, and here again connecting with the Canadian road.

CHARLOTTE, N. C.—A network of interurban trolley lines, connecting Charlotte, N. C., with Greenville, Anderson and Spartanburg, S. C., involving an expenditure of $7,000,000, will shortly be built by the Duke interests, representing Messrs. J. R. and R. N. Duke and W. S. Lee, all prominent capitalists of North Carolina. It is understood that the line will utilize the vast waterpower developed by the properties of the Southern Power Company, in which the Dukes are heavily interested. This line will open up a rich territory, and will probably tap the Seaboard Air Line Railway at Greenwood, S. C., from which place the line will extend on to Charlotte. It is proposed that the cities interested shall take stock in the line, and that they shall give the trolley line fifty per cent of their freight business. I.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

NEW LONDON, WIS.—A farmer's telephone line has been organized in the town of Lebanon to be tributary to the Fox River Lines. C.

BRISTOW, IOWA.—The West Point Mutual Telephone Company has been formed here to build an exchange here as well as at Allison. Z.

WAVERLY, IOWA.—The Washington Rural Telephone System Company, capital, $6,000, has been incorporated. H. O. Steege is secretary.

DEADWOOD, S. D.—The Nebraska Telephone Company is considering the expenditure of $85,000 this year to complete improvements started last year. C.

INDIANAPOLIS, IND.—A contract for installing a new Gamewell fire-alarm telegraph system in this city has been awarded to the Western Electric Company. S.

ABBOTT, OKLA.—The Abbott Telephone Company has been incorporated for $1,000. The incorporators are Claude Chapman, Fred Blankenship and R. J. Ross.

WALDRON, IND.—The local telephone system has been purchased by J. W. Buckingham, of Morristown. The plant will be improved and the lines extended. S.

MISHAWAKA, IND.—It is reported that a contract has been awarded to the Gamewell Fire Alarm Company for the installation of a police alarm system at $3,000. S.

BRISTOW, IOWA.—The West Point Telephone Company has been incorporated with capital stock of $20,000. The officers are President, J. W. Piper; treasurer, J. H. Richardson, and secretary, J. C. Jungkunz. Z.

MASON CITY, IOWA.—At the annual meeting of the Western Electric Telephone Company, in Des Moines, Iowa, $15,000 was appropriated for improvements during 1911. C.

BELLEFONTAINE, O.—The property of the Mt. Victory Telephone Company, with 400 telephones, has been sold to the United Telephone Company, for the sum of $19,250. H.

REDWOOD FALLS, MINN.—The Redwood County Rural Telephone Company is planning the construction of lines through Vesta township and also to Lamberton from Wabasso. C.

MARSHALLTOWN, IOWA.—The Merchants, Mechanics & Farmers' Telephone Company will commence the erection of an automatic plant about March 1. The cost is to be $100,000.

BROADVIEW, MONT.—The Treasure State Telephone Company has been incorporated with a capital of $25,000. The incorporators are H. W. Bangert, A. Bouchard and E. B. Kingman.

WINCHESTER, IND.—The Farmers' Telephone Company has been incorporated with capitalization of $10,000. The incorporators are Clarence Mullen, Leander Moorman and Omar Venlandingham. Z.

LITTLE CHUTE, WIS.—The Fox River Valley Telephone Company has its line nearly completed. The line will extend from this city through Freedom and partly through the Indian Reservation.

WAUSAU, WIS.—The contract for the erection of an office and telephone building has been let to John Anseres & Son, Wausau, at $33,122. Van Ryn & DeGelleke, of Milwaukee, Wis., are the architects. C.

BINGHAM LAKE, MINN.—The Bingham Lake Rural Telephone Company has been incorporated with a capital of $2,000. The incorporators are John H. Henderson, V. E. Rogers and Wm. H. Dummett, Jr.

ANTIOCH, ILL.—The Antioch Telephone Company has been incorporated with a capital stock of $2,500 to operate a telephone line. The incorporators are Wallace E. Drom, Charles T. Richards and Jay B. Cribb. Z.

WEST PLAINS, MO.—The West Plains & Howel Telephone Company has been purchased by J. W. Boyer and L. F. Boyer of Lake Charles, La., who state that they will make many improvements in the system.

UPPER ALTON, ILL.—The Kinloch Telephone Company's lines will connect with the Upper Alton Exchange of the Star Telephone Company after January 31 superseding the Central Union Telephone Company's Lines. Z.

HOOKER, OKLA.—The Farmers Mutual Telephone Company has been incorporated for $1,500, by E. D. Hubbard, J. C. Wallace, Cecil and C. C. Adams, F. A. Bateman, William McDowell, Charles Pitts, Thomas Decker and J. S. Wallace.

GREENSBURG, IND.—The contract between the Decatur County Independent Telephone Company and the Central Union Telephone Company, by which the former obtains the field here for twenty years, has been perfected and is now in effect.

DUQUOIN, ILL.—Farmers of Perry County have organized a telephone Company with the following officers: President, W. F. Bills, Swanwick; vice-president, W. F. Ahlers, Matthews, and Secretary and treasurer, Charles Schmalriede, of Pinckneyville. Z.

NEWCASTLE, IND.—The Central Union Telephone Company is completing improvements in this city at a cost of over $35,000, which include a number of new lines and the practical replacement of all cables in the city with larger ones. The company now has more than 1200 subscribers here.

MILWAUKEE, WIS.—The Wisconsin Telephone Company has under consideration the following improvements: An addition of 6,000 miles of new toll wire, $350,000; new telephone exchange at Appleton, $100,000; Beloit, $75,000, and Milwaukee, $100,000, and miscellaneous improvements, $200,000.

SOUTH BEND, IND.—Control of the South Bend Home Telephone Company, the largest Independent company in northern Indiana, has passed to the Automatic Electric Company, of Chicago, and at the annual meeting Sanford F. Harris, Chicago, was elected president in place of Theodore Thorward. The other officers are Horace G. Miller, vice-president; Elmer R. Stoll, secretary-treasurer, and H. A. Harris, treasurer.

FOND DU LAC, WIS.—The Fond du Lac Rural Telephone Company and the Empire Telephone Company were combined under the name of the former at the annual meetings of the stockholders. The officers elected at the meeting were: President, William C. Ray; vice-president, John M. Dowd; secretary and treasurer, William T. Reill. It is understood that the company's lines are to be extended and that improvements are to be made. The capital stock of the new concern is $20,000.

ELECTRICAL SECURITIES.

During the past week stocks in general showed a higher tendency although many of the issues showed only a fractional change. The volume of trading was smaller than during the week previous. Transactions in bonds were, however, better, and although there was some halt in business due to the pending decisions of the Interstate Commerce Commission, conditions are extremely favorable. The report of the United States Steel Corporation showing the tonnage of unfilled orders on hand was hailed as a favorable sign as the amount was considerably higher than the preliminary estimates. The Company's mills are running at about fifty-eight per cent capacity and bookings in January were at the rate of 30,000 tons a day, comparing with 22,000 late in 1910.

At the annual meeting of the Detroit United Railway, R. B.

VanCortlandt resigned as a director. Other directors were re-elected.

At the annual meeting of the Detroit Edison Company directors were re-elected. H. F. Kroyar, assistant secretary, has been elected secretary of the Company, to succeed S. W. Burt, resigned. The same change was made in the Eastern Michigan Edison Company. Other officers were re-elected.

The Kings County Electric, Light & Power Company has elected James N. Wallace of the Central Trust Company, as director, succeeding the late Hugh J. Grant. Last month Mr. Wallace was elected to the board of the Edison Electric Illuminating Company of Brooklyn, filling a similar vacancy.

Earnings of the Southern New England Telephone Company for the fiscal year ended December 31 were the largest in the company's history, gross showing an increase of more than nine per cent over 1909. Net profits were $557,345, compared with $546,403 in 1909, equivalent to 7.2 per cent on the $7,693,700 stock. After payment of dividends, surplus was $95,723, as compared with $84,780 in 1909.

The Underground Electric Railways Company of London, Limited, gives notice that the interest on the six per cent income bonds of 1948 for the half-year ending December 31, 1910, at the rate of one per cent per annum, free of British income tax, will be paid on and after March 1 in New York at the New York Trust Company.

DIVIDENDS.

Detroit United Railway Company; a quarterly dividend of one and one-quarter per cent, the first dividend since 1907, when three and three-quarters per cent was paid. The dividend is payable March 1.

General Electric Company; the regular quarterly dividend of two per cent, payable April 15 to stock of record March 4.

Kings County Electric Light & Power Company; the regular quarterly dividends of two per cent, payable March 1 to stock of record February 17.

The Philadelphia Electric Company; the regular quarterly dividend of one and one-half per cent, payable March 15, as registered February 21.

Rochester Railway & Light Company, preferred quarterly dividend of one and one-quarter per cent, payable March 1.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.

	Feb. 13.	Feb. 6.
Allis-Chalmers common	8¼	8⅜
Allis-Chalmers preferred	32	33¼
Amalgamated Copper	66	66
American Tel. & Cable	82	82
American Tel. & Tel.	145½	146
Brooklyn Rapid Transit	78⅝	79⅛
General Electric	155½	154
Interborough-Metropolitan common	20¼	19⅞
Interborough-Metropolitan preferred	55⅛	54¼
Kings County Electric	123	123
Mackay Companies (Postal Telegraph and Cables) common.	93	93¾
Mackay Companies (Postal Telegraph and Cables) preferred.	76	75¾
Manhattan Elevated	139	138
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
Pacific Tel. & Tel.	52⅛	53¼
U. S. Steel common	81⅝	81½
U. S. Steel preferred	119¼	120¾
Western Union	74	74¾
Westinghouse common	69¾	68
Westinghouse preferred	118	116

*Last price quoted.

BOSTON.

	Feb. 13.	Feb. 6.
American Tel. & Tel.	145½	146¼
Edison Elec. Illuminating	290	291
General Electric	155½	154
Massachusetts Electric common	17	18
Massachusetts Electric preferred	87½	87
New England Telephone	140	140
Western Tel. & Tel. common	22	22½
Western Tel. & Tel. preferred	93	93

PHILADELPHIA.

	Feb. 13.	Feb. 6.
American Railways	44½	44¼
Electric Company of America	12	12⅛
Electric Storage Battery common	54	54½
Electric Storage Battery preferred	54	54½
Philadelphia Electric	16¼	16⅝
Philadelphia Rapid Transit	20	20⅞
Philadelphia Traction	86½	86½
Union Traction	47	47¾

CHICAGO.

	Feb. 13.	Feb. 6.
Chicago Railways, Series 1	90	90
Chicago Railways, Series 2	24½	25
Chicago Subway	4	4
Chicago Telephone	122½	119
Commonwealth Edison	115	114
Metropolitan Elevated common	20½	20½
Metropolitan Elevated preferred	65	65

PERSONAL MENTION.

JACK C. FISHER has been appointed city electrical inspector of the City of Kankakee, Ill.

T. S. WILLIAMS has been elected president of the Brooklyn Rapid Transit Company, taking the place of E. W. Winter, who resigned.

SANFORD F. HARRIS, of Chicago, has been elected president of the South Bend Home Telephone Company, of South Bend, Ind.

J. M. BRAMLETTE, who superintended the completion of the Jackson-Lansing electric suburban line, has recently been made the manager of the city lines at Jackson.

A. H. WHITE, manager of the Joliet exchange of the Chicago Telephone Company has been made district manager. His territory is to include the exchanges at Joliet, Lockport, New Lenox, Plainfield, Lemont, Manhattan, Minooka and Elwood.

J. H. POYNTING, F. R. S., professor of physics in the University of Birmingham, been awarded the Hopkins prize for the period 1900-1903 for his researches on the transmission of energy in the electromagnetic field and on the pressure of radiation.

L. H. LATHROP has been appointed to succeed W. R. Putnam as superintendent of the Menominee & Marinette Light & Traction Company. Mr. Lathrop is a graduate of the University of Michigan, and was formerly with the Milwaukee Electric Railway & Light Company.

ROBERT MATHER, chairman of the Board of Directors of the Westinghouse Electric & Manufacturing Company, recently returned from a business trip in Europe. He states that he found business conditions in Europe, and especially in Great Britain, to be very satisfactory.

HARRY CURTIS RICE, vice-president and manager of the General Incandescent Lamp Company of Cleveland, O., was united in marriage to Miss Edna Tyler Kindelon of Oakland, Cal., February 7. The ceremony was performed in Lynn, Mass., Mr. Rice's former home. Mr. and Mrs. Rice are spending their honeymoon on an excursion through the southern states.

OBITUARY.

J. A. E. HOEVELER, superintendent of overhead construction of the Allegheny County Light Company, Pittsburg, died of pneumonia on the morning of February 6. Mr. Hoeveler was a pioneer in the electric lighting business, having started with the old East End Lighting Company of Pittsburg twenty years ago.

SAMUEL A. BUFFINGTON, president of the Consolidated Gas & Electric Company, of Chicago, died February 8 of inflammatory rheumatism at his residence in Chicago. He was thirty-eight years of age. In 1908 he founded the Chicago Telephone Supply Company. He was president of the Land Company of North America and president of the Giant Construction Company, which founded the town of New Chicago, Tex. He is survived by his widow and one son.

JAMES McMILLAN SMITH, for a number of years vice-president and general manager of the Southern Michigan Railway Company, but more recently secured by the receiver for the Toledo & Chicago Interurban Railway Company as general manager, died at the home of his daughter in South Bend, Ind., on February 6. Mr. Smith had been ill for several weeks. The deceased was born near Celina, Tenn., February 13, 1853. It can be said of Mr. Smith that he was a self-made man. When a mere boy he was bound out by his parents to a grocer, but as the work did not prove to his liking he left his employer and learned telegraphy. He entered the employ of the Chicago & Alton Railroad as a telegraph operator, later going to the Pullman Palace Car Company as cashier and finally as private secretary to George M. Pullman, president of the company. In 1888, Mr. Smith resigned his position with the Pullman Company and entered business in Chicago, manufacturing rolling mill machinery, heavy forgings and hammers. The following year he disposed of his interest in this business and became manager of a street railway in Des Moines, where he consolidated two rival lines. He also materially improved and extended the service and financed a new corporation. His interests here were soon disposed of at a profit and he went to South Bend where he purchased the South Bend Street Railway property and later organized the South Bend & Mishawaka Railway Company and the General Power & Quick Transit Company. Under his management the lines were extended throughout the city and the problems of electrification were worked out to a practical solution. In 1897 Mr. Smith became associated with the Hon. Arthur Kennedy of Pittsburg, and reorganized the local properties under the name of the Indiana Railway Company. The system was entirely rebuilt at that time, the service being suspended for nearly a year. The new company connected Elkhart and Goshen by interurban, which was then extended to South Bend. In 1901 Mr. Smith and Mr. Kennedy organized the Southern Michigan Railway Company, completing the line as far as Niles in 1903 and to St. Joseph, Mich., in 1906. The street railway systems of Michigan City and Laporte were acquired and operated and finally connected with South Bend by interurban. When the properties were acquired by the present Murdock Company, Mr. Smith resigned, retaining his interest, however, in the Southern Michigan Company, of which he was general manager, until about a year ago, when that property was purchased by the Murdocks. Since then Mr. Smith devoted a part of his time to the promoting of a road at McAlester, Okla. Mr. Smith is survived by a wife and daughter.

FOREIGN TRADE OPPORTUNITIES.

NO. 6104. LIGHTING SUPPLIES.—A commission agent in a European country informs an American consul that he desires to hear from manufacturers of electric wires for weak and strong current and of iron gas fittings (connections). He believes that a good business can be done in these articles. Correspondence may be in English.

NO. 6106. ELECTRIC-POWER ENTERPRISE.—A report from an American consul in Latin America contains particulars of the organization and plans of a new company which will establish a large hydroelectric plant. American manufacturers of electric machinery and equipment should look after this business directly if they desire to have the first opportunity to sell the materials which will be required to complete the plant and transmission system.

NO. 6107. ELECTRIC-LIGHT PLANT.—A consul in Asia states that a municipality has decided to erect a central electric-light station at an estimated cost of about $85,000.

NO. 6116. ELECTRIC TRAMWAYS AND ELECTRIC POWER.—The American embassy at Constantinople, Turkey, has forwarded copies of the particulars of an adjudication concerning a concession of electric tramways in the city of Adrianople and the establishment of electric power in the Vilayet of Adrianople; also a concession for electric tramways in the city of Adana and the establishment of electric power in the Vilayet of Adana, which the Minister of Commerce and Public Works has sent to the embassy. These publications can be obtained by interested persons upon application to the Bureau of Manufactures.

NO. 6122. AUTOMATIC TELEPHONES IN AUSTRALIA.—Consul General John P. Bray, of Sydney, reports that the Federal Postal Department of the Government of the Australian Commonwealth, controlling telephone matters, has announced its intention of calling for proposals, in the near future, for at least one automatic telephone installation similar to those now in use in certain cities of the United States.

NEW INCORPORATIONS.

CHICAGO, ILL.—V. Weber & Company have incorporated with a capital of $100,000 to manufacture and deal in electrical apparatus. The incorporators are Howard M. Cox, Max S. Rosenzweig and Dwight B. Cheever.

ROCKFORD, ILL.—The Atwood Vacuum Cleaner Company has been incorporated with capital stock of $50,000, to manufacture electrical machinery. The incorporators are James T. Atwood, Howard C. Atwood and Myra C. Atwood. Z.

CHICAGO, ILL.—The Charles H. Debs Company with capital stock of $5,000, has been incorporated to manufacture and deal in electrical and gas fixtures. The incorporators are Joseph Rogenberg, Charles H. Debs and Charles L. Cohns. Z.

DAYTON, O.—The Vaile-Kirnes Company, manufacturers of hydraulic, electrical and pneumatic machinery, has incorporated with a capital stock of $100,000. The incorporators are J. Henry Vaile, Hugh W. Kimes, Claude E. Burnett, David L. Stange and Oscar M. Gottschall.

INDIANAPOLIS, IND.—The Hoyt Light Sales Company has incorporated to take over the Welchel Electric Company of Anderson, Ind., and to handle the product manufactured by that company. The plant will be moved to Indianapolis, where a high-tension magneto for automobiles and stationary gasoline engines will be manufactured. S.

NEW YORK, N. Y.—Articles of incorporation have been filed by the Telephone Booth Renting & Sales Company of New York City. The Company will manufacture, buy and sell telephone booths, fixtures and equipment of every kind. The capital stock is $15,000 and the directors are Eugene W. Walsh, John C. Kelly, Jr., and James H. Walsh of Brooklyn. T.

PROPOSALS.

TELEPHONES.—The chief signal officer of the War Department Washington, D. C., is inviting proposals until February 23, for furnishing forty-three composite desk telephones and sixty common-battery wall telephones. F.

NAVY DEPARTMENT SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on naval supplies on the dates given below. Bidders interested therein should make early application for copies of the schedule, giving the schedule numbers desired. Schedules can be obtained from the Navy Pay Office nearest each navy yard. Bids will be asked on the following supplies:

Date of Opening.	Material.	Quantity.	Place of Delivery.	Schedule Number.
Feb. 28.—	Boxes branch junction, etc.	Miscellaneous..	Norfolk, Va.	3348
	Bells, vibrating, w. t.	30	Norfolk, Va.	3348
	Carbons for arc lamps	5,000	Brooklyn, N. Y.	3348
	Lamp fixtures and interior fittings	Miscellaneous..	Norfolk, Va.	3348

NEW PUBLICATIONS.

REPORT OF THE SMITHSONIAN INSTITUTION.—The annual report of the Smithsonian Institution for the year ending June 30, 1909, has been issued. In addition to the usual report of the secretary on the administration of the institution and its allied interests, there is a general appendix containing reprints of the following papers: "Researches in Radio-Telegraphy," by J. A. Fleming; "Recent Progress in Physics," by J. J. Thomson.

REPORT OF SECRETARY OF COMMERCE AND LABOR.—The eighth report of the secretary of commerce and labor covers the year 1910 outlining the work of the different bureaus under this department. Some account is given of the international investigation on the ohm, volt and ampere, which was held by the Bureau of Standards, in co-operation with the Physikalichè-Technische Reichsanstalt of Germany, the National Physical Laboratory of England, and the Laboratorie Central d'Electricite of France. The delegates of this convention met in Washington during April and May, 1910, and carried out a careful series of experiments on the silver voltameter. Standard cells were measured and standard resistances prepared, many comparisons being made. The numerical value of the Weston normal cell was agreed upon. The report states further that the works on the absolute measure of current is nearly completed and that the reasearch on the properties of mica is completed and ready for publication. Part of the work of the Bureau of Standards is concerned with measuring the incandescent lamps used by the Government and mention of this is also made.

INDUSTRIAL ITEMS.

THE NEW YORK INSULATED WIRE COMPANY, New York, N. Y., advertises Grimshaw splicing compound on a recently mailed blotter.

THE AMERICAN STEAM GAUGE & VALVE MANUFACTURING COMPANY, Boston, Mass., illustrates and describes its safety valves in a recent folder.

THE PAWLING & HARNISCHFEGER COMPANY, Milwaukee, Wis., builder of cranes, hoists, etc., announces the opening of a branch office at 533 Baronne Street, New Orleans, La., under the management of T. W. Waddell.

THE AMERICAN CONDUIT COMPANY, 140 Nassau Street, New York, N. Y., advertises its bituminized fiber conduit for underground construction, on a recent folding post card. Illustrations of the conduit are given and the sizes mentioned.

THE ILG ELECTRIC VENTILATING COMPANY, Chicago, Ill., has just sent out a catalog describing the Ilg fans and blowers. A number of illustrations are used, and there is in addition a considerable amount of data regarding fans, blowers and air-moving plants

THE HURLEY MACHINE COMPANY, Chicago, Ill., illustrates its "Thor" home laundry machines in a recent attractively prepared bulletin. The entire machine is described part by part, the different pieces and the entire assembled machine being shown in the illustrations.

THE GENERAL INCANDESCENT LAMP COMPANY, Cleveland, O., has issued a leaflet under the title, "Twixt Darkness and Dawn." Besides arguments for the G. I. Mazda lamp, the leaflet contains a list of the General Incandescent Lamp Company's representatives and branch offices.

THE SANGAMO ELECTRIC COMPANY, Springfield, Ill., devotes a new bulletin, No. 21, to a comprehensive treatment of the method of testing watthour meters by means of the standard test meter. Complete data are given as to the proper calibrating constants to be used in testing every make of meter on the market.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., describes in Bulletin No. 131 the installation of the "Chloride Accumulator" for the Lake Hopatcong Yacht Club, at Lake Hopatcong, N. J. The plant includes a gasoline-engine-driven generator and a sixteen-cell "Chloride Accumulator" storage battery. The amount of time taken to operate the plant and keep it in good condition is very slight.

THE BRISTOL COMPANY, Waterbury, Conn., has just distributed Bulletin No. 121. This publication is a forty-page illustrated catalog of Bristol's Class III recording thermometers including descriptions and lists of the compensated gas-filled recording thermometers which were discussed in recent issues of the engineering and trade papers. These instruments are being used for a great variety of applications for recording temperatures up to 800 degrees Fahrenheit. A number of prominent users of the recording thermometer are given in the form of a list.

THE ELECTRICAL ALLOY COMPANY, Morristown, N. J., has put on the market a new alloy called the grade "C" material. It is a pure nickel-copper-alloy, non-corrosive material, having a resistance of 164 ohms per mil foot, and which does not become brittle with repeated heating and cooling. It will replace eighteen-per-cent German silver. The company also announces that it has placed on the market a new high-grade phosphor-bronze armature-branding wire manufactured from an imported alloy. Information may be had on both of these materials from the Electrical Alloy Company.

WICKES BROTHERS, Saginaw, Mich., have issued their February stock list of machinery bargains. The list includes boilers, engines, pumps, machine tools, electrical machinery, etc.

DOSSERT & COMPANY, New York, N. Y., announce that their president, H. B. Logan, is making an extensive trip through the South and West in the interest of the company's line of solderless connectors, taps, and terminals for electric wires and cables. He will visit the following cities: Atlanta, Chattanooga, Birmingham, New Orleans, Houston, Dallas, St. Louis, Kansas City, Denver, Salt Lake City, Butte, Spokane, Seattle, Portland, San Francisco, Los Angeles. Any firm interested in the above mentioned specialties can communicate with the home office at New York and Mr. Logan will be instructed to call in person.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has recently closed a contract with the Universal Portland Cement Company for motors to operate its No. 6 Plant at Buffington, Ind. The motors will be of the "MS" mill type, having characteristics specially suitable for cement-mill work, and they will operate from five horsepower to 200 horsepower, and the aggregate capacity is 11,500 horsepower. This plant will be the largest in the United States, having a daily capacity of approximately 12,000 barrels, and will be electrically operated throughout; the various drives being of the latest development for cement-mill work.

THE TRUMBULL ELECTRIC COMPANY, Plainville, Conn, at a recent meeting of stockholders increased its capital stock from $100,125 to $500,000. A certificate has been filed showing the issue of $399,875 of additional stock, and the change of location of the company from Hartford to Plainville, where it has been located for some time. The board of directors has been increased from four to seven and the following officers were elected: President, John H. Trumbull; vice-president, Frank T. Wheeler; secretary and treasurer, Henry Trumbull. Ex-Senator Sloper has purchased $25,000 of the new preferred stock and is to control the sale of the remainder, which will go on the market at $110 a share.

THE WESTERN ELECTRIC COMPANY, New York, N. Y., calls attention to its set of fourteen bulletins covering the field of telephony. The information covered in this collection includes such subjects as magneto, central battery, toll and private-branch-exchange switchboards, magneto and central-battery telephone sets and accessories, switchboard accessories and protector equipment, switchboard power plants, etc. The information is of the helpful sort, abounding in illustrations and diagrams. Nearly all telephone managers are familiar with at least some of these publications, but it may be interesting to know that the whole collection can be obtained by merely writing to the manufacturers.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has received from the Michigan Cement Company, Chelsea, Mich., an order for complete electrical equipment to be installed in its plant. At first only a part of the ultimate amount of power will be generated by two machines, two-phase, one of 200, and the other of 250-kilowatt capacity. Other generators will be installed later. Thirty-five induction motors, aggregating 1,133 horsepower capacity have been ordered for driving the various machines. The switchboard for controlling the output of the two generators and the power company's service transformers will consist of seven panels, two three-phase sixty-cycle generator and exciter panels, four power feeder panels. A thirty-kilowatt transformer, which will carry a lighting load, is included in the order.

DATES AHEAD.

Philadelphia Electric Show, Philadelphia, Pa., February 13-27.

American Physical Society. Next regular meeting, New York City, March 4, 1911.

Minnesota Electrical Association. Annual convention, St. Paul Hotel, St. Paul, Minn., March 14, 15 and 16.

American Supply and Machinery Manufacturers' Association. Annual meeting, Louisville, Ky., April 3, 4 and 5.

American Electrochemical Society. Annual meeting, Chemists' Club Building, New York, N. Y., April 6, 7 and 8.

Missouri Electric, Gas, Street Railway and Water Works Association. Annual meeting, St. Louis, Mo., April 13, 14 and 15.

Iowa Electrical Association. Annual meeting, Davenport, Iowa, April 19, 20 and 21.

Southwestern Electrical & Gas Association. Annual convention, Houston, Tex., April 27-29.

Mississippi Electric Association. Annual convention, Gulfport, Miss., June 20-21.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) February 7, 1911.

983,275. ELECTRIC SWITCH. Frank H. Hallefas, Chicago, Ill., assignor to C. F. Pease Co., Chicago, Ill. Filed May 28, 1910. Consists of two sets of vertically upstanding stationary contacts and swingingly mounted contacts to engage them.

983,284. STARTING DEVICE FOR EXPLOSIVE-ENGINES. Frederic N. Howard, Harris, R. I. Filed Oct. 23, 1907. Comprises a distributing chamber arranged to contain pressure sufficient to start the engine, magnets for controlling the pressure-operated means, and electrical selective means for operating each magnet.

983,291. ELECTRIC HEATER. Milton M. Kohn, New York, N. Y. Filed Oct. 1, 1909. A fireless cooker containing a series of telescoping cylindrical forms, each containing an electric heating element that can be connected in series or multiple with the others.

983,292. ELECTRIC HEATER. Milton M. Kohn, New York. Filed Oct. 30, 1909. Comprises a base, a number of soil holders removably secured thereto, a heating coil in each coil holder, and a grid supported in movable relation to the base.

983,308. ARMATURE FOR MAGNETO-ELECTRIC MACHINES. Carl A. Pfanstiehl, Highland Park, Ill., assignor to Pfanstiehl Electrical Labatory, North Chicago, Ill. Filed April 18, 1910. Renewed Dec. 14, 1910. An armature frame has parallel pole pieces, and a core formed of a bundle of wires, whose ends are homogeneously connected to each other and to the outer surface portions of the pole pieces.

983,320. INSPECTION DEVICE FOR WEARING-APPAREL. Jacob A. Snyder, Cincinnati, Ohio. Filed June 20, 1910. A frame for supporting a garment is rotatably mounted on a vertical shaft, through which pass the connections for an incandescent lamp in the frame.

983,345. THERMOSTAT. Julius Boekel, Philadelphia, Pa. Filed April 30, 1910. Into a receptacle containing a conducting fluid extends a contact point. The latter and the receptacle are connected to an alarm circuit.

983,360. X-RAY FRAME. Amedee Granger, New Orleans, La. Filed June 20, 1910. An adjustable framework has means for holding the X-ray tube and a fluorescent screen.

983,361. BACK-GEARED MOTOR. Alexander M. Gray, Milwaukee, Wis., assignor to Allis-Chalmers Co. Filed Feb. 28, 1910. Combined with an electric motor is a main shaft, a frame comprising a movable yoke and stationary end heads which have supporting portions and which are secured to the yoke, and a counter shaft mounted on the yoke.

983,364. FIXTURE-LAMP. Max Harris, Pittsburg, Pa., assignor to Nernst Lamp Co., Pittsburg, Pa. Filed Nov. 11, 1908. On arms extending from a central fixture body are mounted the heaters and glowers of a set of Nernst lamps. The ballasts and cut-outs for all the lamps are placed within the central nxture body.

983,380. CONTROLLER. Charles E. Lord, Norwood, Ohio, assignor to Allis-Chalmers Co. Filed June 30, 1906. In a separate casing below the car floor and directly beneath the controller is a circuit-breaker which opens when the handle is thrown to "off" position and on abnormal load.

983,396. AUTOMATIC FIRE-ALARM. Edward F. Oliver, Monroe, Ind. Filed Dec. 4, 1909. A fire-extinguishing and alarm system comprises means for automatically delivering extinguishing material and sounding a local alarm when the temperature reaches a certain degree, and means automatically sounding a fire-station alarm when the temperature reaches a certain degree above the local alarm-sounding degree, all of which is electrically operated.

983,399. RECIPROCATING MECHANISM. Howard H. Ralston, Norwood, Ohio, assignor to Allis-Chalmers Co., and Bullock Electric Manufacturing Co. Filed April 20, 1907. The brush groups on a commutator are reciprocated axially by a means operated by the rotation of the machine and independent of the brush yoke.

983,403. ELECTRICAL SIGNALING DEVICE. Jey Glenn Schafer, Brighton, Iowa. Filed May 24, 1909. A series of contacts is arranged on the bottom of a tank and connected to a signal and alarm circuit.

983,414. APPARATUS FOR REGULATING OR CONTROLLING THE PRESSURE OF THE CURRENT IN AN ELECTRIC CIRCUIT. Jacob Watkinson and Albert E. Payne, London, England. Filed June 13, 1910. A set of resistances is provided with a separate contact-plate for each resistance. A pivoted switch arm carries a roller adapted to contact the plates in succession.

FOR USE IN ALKALINE ACCUMULATORS. Axel Theodore Konstantin Estelle, Fliseryd, Sweden, assignor to Nya Ackumulator Aktiebolaget Jungner, Fliseryd, Sweden. Filed March 19, 1910. Consists in subjecting a solution of ferrous sulphate to electrolysis in the presence of a solution of a cadmium salt.

983,443. ELECTRICAL ALARM-THERMOMETER. Robert Heddle, Nelson, British Columbia, Canada. Filed June 21, 1909. A number of bars of different coefficients of expansion are secured together to form a thermostat having an indicator and scale provided with an adjustable contact point connected to an electric alarm.

983,457. SHADE-HOLDER. Walter H. Perkins, Cheshire, Conn., assignor to Waterbury Manufacturing Co., Waterbury, Conn. Filed September 19, 1910. The shell of the shade-holder has a lamp-socket-receiving collar with a set of clamping wires and a clamping lever.

983,489. IGNITER. Henry N. Fullenweider, Waveland, Ind. Filed April 18, 1910. An igniter for gas burners is mounted so to prevent the conductor wire grounding on the burner.

983,491. SANITARY APPLIANCE FOR TELEPHONES. George T. Hadley, San Francisco, Cal. Filed January 10, 1910. On the outside of the transmitter mouthpiece is clamped a nearly spherical perforated resonator.

983,496. SPEED-INDICATOR. Richard John Hutchinson, Birkenhead, and Albert Barton Grindrod, Rock Ferry, England. Filed October 25, 1909. The revolving part carries a number of arranged for having the end of an incandescent lamp threaded thereinto at selective points longitudinally thereof.

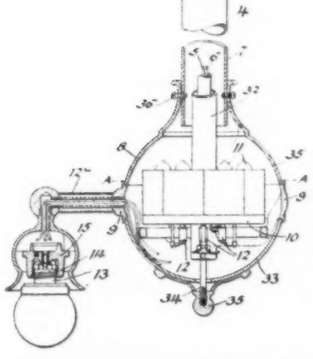
983,570. HOLDER FOR TELEPHONE-RECEIVERS AND THE LIKE. Sigmund K. Rothschild, Detroit, Mich. Filed November 4, 1910. A metallic envelope is so fixed to the ordinary receiver as to be freely rotatable.

983,573. SUSPENDED INSULATOR. Cleon W. Schultz, Scranton, Pa., assignor to H. W. Johns-Manville Co. Filed January 3, 1910. A metallic shell is filled with insulating material in which is imbedded a support for the trolley wire. The shell itself is supported by means of a separate piece retained by set screws.

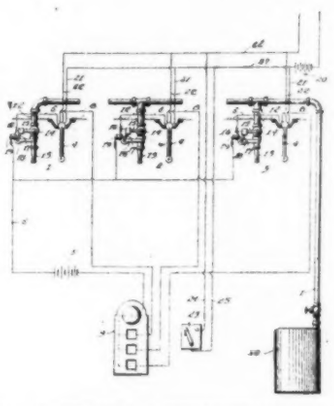
983,657. ELECTROMAGNETIC VIBRATOR. Chester H. Thordarson, Chicago, Ill., assignor to Sam J. Gorman, Chicago, Ill. Filed August 4, 1905. The applicator is actuated by an electromagnet, and a cam is provided for limiting the degree of vibration.

983,660. ELECTRIC SWITCH. Charles S. Van Nuis, Philadelphia, Pa. Filed July 26, 1907. A stationary contact member is retained within the base by means of a molded mounting, there being additional means to retain the mounting within the base.

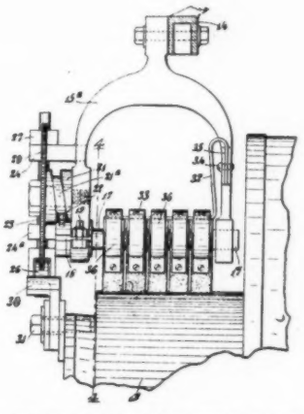
983,670. ALTERNATING-CURRENT SYSTEM OF DISTRIBUTION, REGULATION, AND CONTROL. Joseph Bijur, New York, N. Y., assignor to Electric Storage Battery Co., Philadelphia, Pa. Filed March 29, 1906. The combination of an alternating-current source of supply, an alternating-current work circuit, a storage battery to compensate for variations in the



983,364.—NERNST LAMP FIXTURE.



983,396.—COMBINED EXTINGUISHING AND ALARM SYSTEM.



983,399.—BRUSH-RECIPROCATING DEVICE.

electromagnets and a moving switch which energizes them in succession and then de-energizes them so that they return to normal position. The magnets actuate the indicator.

983,500. ELECTRIC REGULATOR. Haroutiun K. Kouyoumjian, St. Louis, Mo. Filed April 26, 1910. A pair of commutators each comprise two sets of segments, resistance elements connected in series with the segments, an arm pivotally mounted between the commutators, the ends of which arm travel adjacent the faces of the segments forming the commutators, and each end of the arm being adapted to adjustably receive brushes.

983,519. MOTOR-CONTROL SYSTEM. Emmett W. Stull, Milwaukee, Wis., assignor to Allis-Chalmers Co., Milwaukee, Wis. Filed September 10, 1909. Comprises a power-operated controller for varying the resistance in circuit with a set of railway motors, and a manually operated master controller, which also directly makes the conections for putting the motors in series and part of the connections for putting the motors in parallel.

983,536. METHOD OF REMOVING STATIC ELECTRICITY. William H. Chapman, Portland, Me. Filed January 23, 1908. One side of high-tension source is connected to ground and the other to a conductor of large area and insulated surface mounted near the belt or moving sheet. A small wire is also mounted near the sheet and grounded.

983,548. METHOD AND APPARATUS FOR EQUALIZING TEMPERATURE. Horace B. Gale, Natick, Mass., assignor to Simplex Electric Heating Co., Cambridge, Mass. Filed September 19, 1910. An electric steam boiler whose area of water-heating surface is continuously regulated responsively to the pressure and therefore demand for heat.

983,558. ELECTRIC SIGN. Edward A. Leopoldt, Cincinnati, Ohio. Filed October 9, 1909. A combination of an elongated electric socket embracing an elongated side-member curved transversely on its inner face and an elongated bottom-member, and load, regulating means responsive to both the variations in the work circuit and the direction and amount of current of the storage battery, and operated by variations in the work circuit. The regulating means starts to operate when the load on the work circuit varies from the average, and continues to operate until the energy given out by the battery or absorbed thereby compensates for the increase or decrease of energy demanded by the work circuit.

983,701. INSULATOR FOR ELECTRIC INSTALLATION-CANOPIES. George W. Gardiner, Chicago, Ill. Filed September 12, 1910. A conduit passes through the central opening of the canopy, there being a hard-rubber threaded sleeve arranged on the conduit and passed through the opening. A flange on the sleeve has a shoulder on which the canopy is seated, a metallic nut screwed on the sleeve holding the canopy in position on the shoulder.

983,703. ELECTRICAL WRITING APPARATUS. Dinshah Pestanji Framji Ghadiali, Surat, India. Filed May 21, 1909. The apparatus has a normally open circuit including a source of electrical energy, a writing desk connected to one pole of the source and forming one contact element of the circuit, and a pen having one end connected to the other pole of the source and the other end provided with a needle and forming the other contact element.

983,713. FIRE-ALARM. Stephen J. Heinrich, Bellevue, Pa., assignor to American Electric Alarm Co., Pittsburg, Pa. Filed March 14, 1906. Comprises a main signal circuit, a transmitter adapted to send a signal over the circuit, this transmitter including a clock train and an electro-magnet, means for normally maintaining the magnet energized and the train locked, means operating upon the de-energizing of the magnet for causing the train to be released and the transmitter to send its signal, means for arresting the train after such signal has been sent, means operated by the movement of the train for re-energizing the magnet, and means then

operating them for again releasing the train, and permitting the transmitter to repeat the signal.

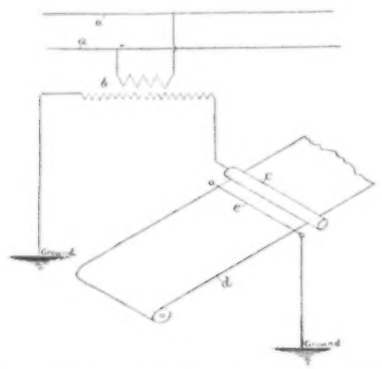
983,717. ELECTRIC TOY. Albert Huck, Nuremberg, Germany, assignor to Karl Bub, Nuremberg, Bavaria, Germany. Filed March 29, 1910. A toy electric motor with permanent field magnets.

983,727. ELECTROCHEMICAL PROCESS FOR CLEANING AND POLISHING SILVER PLATE AND THE LIKE. Anthony Maurice Kohler, Brixton, London, Eng. Filed July 6, 1909. Consists in immersing in a receptacle containing an aluminum salt solution, aluminum and the article to be cleaned, hydrogen thereby being liberated and combined with the oxide on the article to produce water.

983,737. SPARK-PLUG. Harry Ellsworth Maher, Crookston, Minn., Filed April 28, 1910. A V-shaped electrode has upper and lower flanges providing for two sparks, one acting as auxiliary to the other.

983,738. SPARK-PLUG CONNECTOR AND SWITCH. George W. Manville, Towanda, Pa. Filed April 5, 1910. A connector and switch are detachably mounted on the top of the spark plug.

983,742. ELECTRIC HAND-LAMP. John W. Mead, Buffalo, N. Y., assignor of one-half to Albert H. Deremo, Buffalo, N. Y., one-sixth to Gustin Welch, Niagara Falls, N. Y., and one-sixth to Duncan A. Carmichael and one-sixth to Estella Beeman, Buffalo, N. Y. Filed April 20, 1910. A small magneto operated by clockwork is mounted in a case having the shape of a pistol handle. Current is supplied to a miniature incandescent lamp by means of the magneto, which is set in operation by the pressure of a trigger.



983,536.—REMOVING "STATIC" FROM PAPER, BELTS, ETC.

983,760. BATTERY AND HOLDER. George Lewis Patterson, New York, N. Y., assignor to Alice C. Patterson, New York, N. Y. Filed May 26, 1908. Comprises a circular base having pepending, cell-engaging fingers or clips, a conducting member having a resilient portion extending laterally from the base, the outer end of the member extending below the plane of the base and arranged to engage a portion of an adjacent cell.

983,786. TORPEDO OR BOMB. Walter J. Turnbull, New Orleans, La. Filed June 14, 1910. An explosive bomb is set off by a spark supplied by an electric battery.

983,817. ELECTRIC-CIRCUIT-CONTROLLING MEANS. Charles J. Fox and William C. Grein, Rochester, N. Y. Filed July 9, 1910. Two parts of insulated contacts spaced apart are mounted on the base; a plug adapted to engage through an opening in the base and between the contacts of the first pair electrically connects them; a key-actuated member movably mounted on the base is adapted in one position to extend over the opening for the plug in the base to prevent the insertion thereof and means are provided whereby, when the key-actuated member is moved to its other position, electrical connection is established between the second pair of contacts.

983,835. POWER-FACTOR CONTROLLER. John Pearson, Somerset, Wis., assignor of one-third to James F. Williamson and one-sixth to Frank D. Merchant, Minneapolis, Minn. Filed July 20, 1907. Combines with synchronous electric machines running in parallel, an exciter connected in the field of one of the synchronous machines, a rheostat in the field circuit of the exciter, reversely acting solenoids and connections for adjusting the rheostat, reversely acting relays with connections for controlling the solenoids, the relays having coils permanently connected in the exciter circuit. Electrical connections with the exciter circuit includes a pair of fixed contacts for energizing the opposition coils on the relays, and an automatic power-factor regulator having relatively fixed and relatively movable windings, one subject to current changes and the other to voltage changes in the line.

983,853. DRIVING MEANS FOR MAGNETO GENERATORS. Orville E. Wooldridge, Greenville, Ill. Filed April 11, 1910. The engine using the magneto pumps fluid which drives the magneto.

983,861. THERMOSTATIC ALARM. Clark H. Pool, New York, N. Y., assignor to International Electric Protection Co. Filed March 9, 1909. A conduit for fluids has a valve and circuit terminals, one of which is a spring normally held in contact with the other terminal directly by the valve when seated and separating from the other terminal to break circuit upon the lifting of the valve. An alarm device operates by the breaking of circuit.

983,862. ELECTRIC JACQUARD-MACHINE FOR FIGURE-WEAVING WITHOUT CARDS. August Regal, Jagerndorf, Austria-Hungary. Filed December 20, 1909. Electromagnets operate the threads, taking place of the ordinary Jacquard cards.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired February 13, 1911:

514,460. ELECTRICAL CONDUCTOR. Dallas B. Hayward, Easton, Md.

514,461. ELECTRICAL SIGNAL APPARATUS. George W. Hey, Syracuse, N. Y.

514,462. ELECTRICAL APPARATUS. George W. Hey, Syracuse, N. Y.

514,480. CUT-OUT. Hermann Lemp, Lynn, Mass.

514,491. ELECTRICAL FIREARM. John L. McCullough, Brooklyn, N. Y.

514,501. ELECTRICAL ANNUNCIATOR. Charles F. Scattergood, Albany, N. Y.

514,504. CURRENT REGULATOR FOR DYNAMO-ELECTRIC MACHINES. Charles E. Scribner, Chicago, Ill.

514,505. ELECTRIC ARC LAMP. Charles E. Scribner and Ernest P. Warner, Chicago, Ill.

514,506. ELECTRIC-ARC LAMP. Charles E. Scribner, Chicago, Ill.

514,554. MAGAZINE-FUSE FOR ELECTRIC CIRCUITS. Charles E. Jones, Cincinnati, O.

514,561. ELECTRIC RAILWAY. Paul W. Leffler, Minneapolis, Minn.

514,566. ELECTRIC-RAILWAY CROSSING SIGNAL. Michael J. O'Sullivan, Baltimore, Md.

514,580. APPARATUS FOR TESTING THE RESISTANCE OF CONDUCTORS OF ELECTRICITY. Elmer G. Willyoung, Philadelphia, Pa.

514,581. ELECTRICAL MEASURING INSTRUMENT. Elmer G. Willyoung, Philadelphia, Pa.

514,582. ELECTRICAL MEASURING INSTRUMENT. Elmer G. Willyoung and Madison M. Garver, Philadelphia, Pa.

514,583. ELECTRIC-ARC LAMP. John E. Woolverton, New York, N. Y.

514,586. ELECTRICAL TRANSMISSION OF POWER. Charles S. Bradley, Yonkers, N. Y.

514,593. ELECTRICAL MEASURING INSTRUMENT. Madison M. Garves and Elmer G. Willyoung, Philadelphia, Pa.

514,641. ELECTRIC PENDULUM CLOCK. Henri Campiche, Geneva, Switzerland.

514,651. ELECTRIC CIGAR-LIGHTER. Alexander J. Graydon, Indianapolis, Ind.

514,665. POLE FOR ELECTRIC RAILWAYS. Edward W. Serrell, New York, N. Y.

514,686. ELECTRIC ANNUNCIATOR. Israel E. Rickey, Oakland, Cal.

514,695. TELEPHONE. Charles T. Bloomer, New York, N. Y.

514,697. ELECTRIC ALARM FOR PRESSURE-GAGES. William H. Bradt, Troy, N. Y.

514,714. BOND-WIRE FOR ELECTRIC CONDUCTORS. Albert Hoffman and Joseph Brogan, Milwaukee, Wis.

514,718. ELECTRIC-RAILWAY SYSTEM. Paul W. Leffler, Minneapolis, Minn.

514,739. INCANDESCENT ELECTRIC LAMP. George H. W. Timbrell and John C. Fyfe, Denver, Colo.

514,745. SAFETY ATTACHMENT FOR TELEGRAPH-SIGNALS. Charles W. Babbitt, Jackson, Mich.

514,746. APPARATUS FOR PERIODICALLY COMPLETING AND INTERRUPTING ELECTRIC CIRCUITS. Ernest L. Berry and Frederick Harrison, London, Eng.

514,775. ELECTRIC ALARM. Samuel T. Sanders, Granite, Mont.

514,813. ELECTRIC LOCK. Robert V. Cheatham, Louisville, Ky.

514,817. ARMATURE CONNECTION FOR DYNAMOS. Oza Dufault, Spencer, Mass.

514,823. TELEPHONE SIGNALING SYSTEM. Webster Gillette, New York, N. Y.

514,827. ELECTRIC RAILWAY CONDUIT. Robert I. Hampton, Athens, Ga.

514,845. ELECTRIC-BATTERY CELL. Peter C. Burns, Peru, Ind.

514,849. ELECTRIC CABLE. Theodore Guilleaum, Cologne, Germany.

514,850. ELECTRIC SWITCH FOR RAILROADS. William M. Henderson and William C. Henderson, Philadelphia, Pa.

514,878. ELECTRICALLY OPERATED STREET INDICATOR FOR CARS. Henry C. Barker, St. Louis, Mo.